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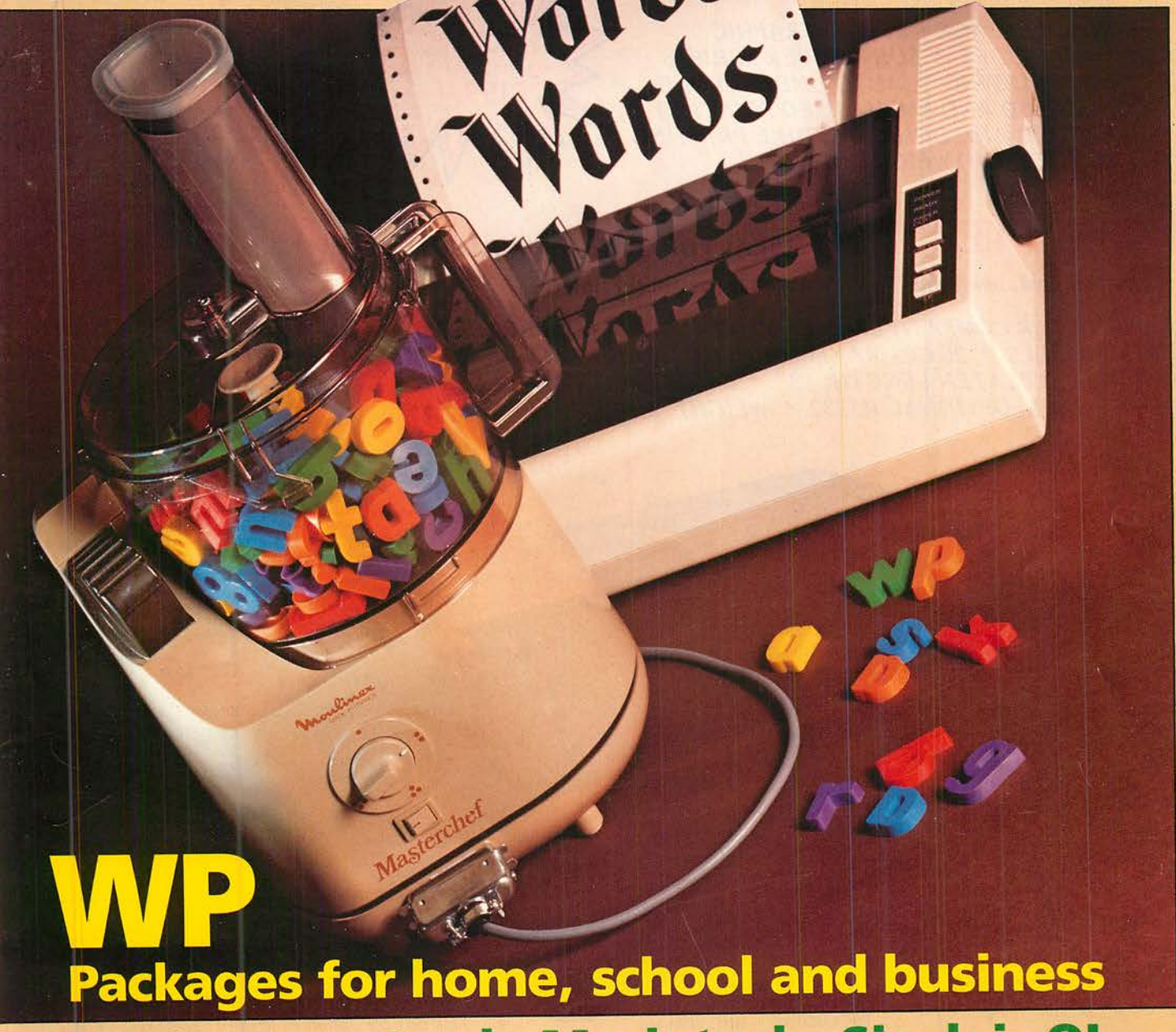

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Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £35 per published page. Submissions should be typed or computer-printed and should include a tape or disc of any program. Handwritten material is liable to delay and error.

Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

Piracy, again

PERSONAL COMPUTER WORLD magazine has recently paid £65,000 to Acorn in a software piracy case, according to press reports.

An item in Guy Kewney's news section in the January issue described in detail how to transfer Acorn BBC programs from tape to disc. Acorn took out a High Court injunction to prevent the sale of the magazine of the grounds that it incited readers to copy its programs.

PCW's editor Jane Bird told our sister magazine *Computer Weekly* that Acorn's claims were "absolute nonsense" and that "it was absurd for them to say this was an incitement to piracy". *Practical Computing's* view is that she is absolutely right.

Unfortunately *PCW* decided not to fight the case, but paid up an out-of-court settlement which enabled sales of the January issue to go ahead. In the short term this presumably satisfies the publishers of *PCW*, but it may have awkward consequences. Computer magazines will in future have to be extremely circumspect in their treatment of legitimate copying, as it may tempt all sorts of people to try to extract large amounts of money from them on completely spurious grounds.

The problem arises because of the ubiquitous confusion about the nature of software in the U.K. The question is, what are you buying when you buy a piece of software? Most answers revolve around the act of physical copying.

Yet copying is something most computer people do every day. At our mother's knee we learned the facts of computer life: program discs are fragile, so take back-up copies straight away. Keep originals in a safe place. Data is valuable: take back-up copies of your own files every day. So we are always looking for more secure and more reliable ways of copying things, just as we are always looking for ways to rescue corrupted data, unlock locked files and undelete deleted files.

Practical Computing's view of software is that it is not so much physical as intellectual property. When you buy it you don't care about the physical embodiment of the program, what you are buying is the right to run it and use it on a particular microcomputer. And logically, if a program is used in a multi-user system then a higher fee ought to be payable.

If software is intellectual property then you are buying the right to run it, and therefore to take as many back-up copies as you need, transfer it from tape to disc and, if necessary, from floppy disc to hard disc. All these things are part of normal life. Of course, you must not sell copies to anyone else — that would still be piracy.

The idea of intellectual property should protect the essence of a program, not just the code or the disc. Why should anyone be permitted to take a popular game, simply translate it for another micro and market it without permission of the game's designers?

It is quite common for film companies to pay large sums of money to authors and publishers for film rights to their books, when they will not even be reproduced in the same medium. Nor is it unusual for computer software companies to pay film companies, and the originators of arcade games, for the right to produce microcomputer versions.

They are all buying intellectual not physical property — which in the case of a game means the right to reproduce, as far as possible, the graphics, movements, sounds and game ideas of the originals. Usually it will also include the right to use the same name, such as "Frogger" or "Defender".

This puts a lot of companies and magazines on interesting ground. It is obvious that Acornsoft's Snapper is a derivation of Atari's Pacman. It is equally obvious that Acornsoft's Planetoids is derived from the Williams arcade game Defender, it so closely resembles the "official version" licensed to Atari. We are not saying the tape or disc has been copied, or that the code has been copied, but the functionality has been copied.

There is no easy answer to these problems — we certainly don't know of one. But at the moment it looks as though the computing industry, while trying to keep the bathwater, is willing to throw out the baby.

5 Years ago...

When Commodore decided to buy its own semiconductor manufacturing company, MOS Technology, it inherited the Kim 1 microprocessor system based on the 6502 CPU.

Kim 1 is assembled on a PC board with 2K bytes of ROM, 1K bytes of RAM, hex keyboard and six-digit LED display. Three manuals accompany the system user, hardware and software.

Memory may be expanded by 4K and 8K RAM using Kim 2 and 3 boards, and a cassette and Teletype interface is already on board.

Software available includes an assembler/disassembler/editor package, an information-retrieval package and a mailing-list program, according to Commodore claims. They are loaded from cassette and prices start at £12.

Kim is marketed in the U.K. by an electronics chain, Marshalls, and by GR Electronics of Newport. The latter offers a pocket terminal for £240 for the input of ASCII characters from 40 keys, and a video board for attachment to a domestic TV set for £150.

If the prices are disconcerting, the price of the Kim should help you change your mind — £99.95.

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Legislation letdown

THE RECENTLY PUBLISHED Green Paper on Intellectual Property Rights and Innovation offers cold comfort to those who were looking to Parliament for legislation to protect the computer industry from the ravages of software pirates. Apart from a gratuitous insult to the teaching profession, which is roundly accused of inciting pupils to copy properietary programs, and a brief mention of the desirability of using patents and registered designs as a national database, the annual theft of, according to some estimates, £700 million worth of software is dismissed with the comment that "specific adaptation of the existing system could be made if felt warranted".

At present software writers who seek a remedy in the courts are setting sail in uncharted waters. The need to interpret existing laws such as the Copyright Act, 1956 and the Patents Act, 1977 which were intended to protect something quite different, means that the outcome is far from certain. Since the cost of a High Court action is counted in tens of thousands of pounds, small software houses are, not unnaturally, reluctant to embark on litigation.

A barrier to early legislation is that the problem is an international one. For an effective solution to be devised, there will have to be a multilateral agreemnt, similar to the Berne Convention on copyright. Although there are moves by private members to introduce a bill in Parliament, without Government backing these seem doomed to failure.

Roger Cullis,
Cranleigh,
Surrey.

Date and algorithms

ONE REASON why the Apple II microcomputer has been so successful as a business and scientific machine is VisiCalc, the original spreadsheet program.

The key concept in a spreadsheet is the idea of a table of entries, where certain entries in the table are arithmetically related to other entries. A typical application is the working out of financial projections.

The success of VisiCalc has spawned other members of the Visi family but one drawback to VisiCalc is that it cannot interface to other programs one might wish to use unless extra packages are purchased. There is not any way in which tabular data produced by ordinary programs can be directly interfaced to VisiCalc. It is always possible for the data produced by another program to be used by VisiCalc, if you are willing to enter the data by hand.

I have written some batch programs in Fortran which performed extensive manipulations of large sets of data, and produced tables of results as disc files. These disc files were then read by Basic programs, to allow interactive examination.

Fortran was used because it was best suited to taking large sets of data and speedily performing complex floating-point calculations.

I used Basic because it was the only interactive language available on-line, and because, for small sets of data, such as tables, in an exploratory analysis, it was sufficiently flexible.

The point is, if microcomputers have a place in more serious large-scale applications, there have to be systems which will allow traditional data-processing — large volumes of data, and fixed algorithms.

To claim that spreadsheet programs — small amounts of data, and changing algorithms — solve data analysis for microcomputers, is not sensible. There now seems to be an industry created to convert files to VisiCalc Dif format, indicating the tendency in microcomputer software to create user-dependency, and forget standards.

Boris Allan,
Stockport,
Cheshire.

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

Pace and panache

L SHANNON — see Feedback, January 1984 — did not get on his Spectrum the hoped for "pace and panache" of John Hooper's suggestion for replacing Gotos by For-Next loops.

The reason is that in Sinclair Basic the return from Next to the beginning of the loop is achieved by exactly the same mechanism as Goto — searching through line numbers from the beginning until the right number is found; and, on the Spectrum, a further search for the right statement in a multi-statement line.

To get the pace and panache you need a Basic interpreter, such as Microsoft, that provided an absolute address for a Next to return to.

W E Thomson,
Aldeburgh,
Suffolk.

Buying for business

I READ the article by Lionel Moon in your January issue with amazement. I cannot believe that he has any idea about business microcomputer systems.

Is he seriously suggesting that all the market leaders in the U.K. are wrong because IBM, Sirius, DEC, Commodore and Apple do not sell systems based on the S-100 bus and 8in. drives? Both of these went out with the dinosaur. In fact the major manufacturers are moving to 3.5in. drives.

His remarks about the benefit of buying expandable systems are correct but our experience of selling over 1,000 micros during the last three years suggests that 95 percent of people want a single-user system; the fact that there is almost no networking software for any of the common systems seems to have escaped him. Multi-user micros themselves are often extremely slow and as such almost impossible to use in business.

On his recommendations for printers I can only say that he has obviously never tried to print out 200 statements at the end of the month on a daisywheel. There is no such thing as the best choice printer, it all depends on the application and most of the time a dot matrix is the better choice.

The only useful paragraph is the one recommending the choice of the software first. I cannot understand why people want to buy an updatable system; if you update it the chances are that your software will not run and you are still paying for the first system anyway. If you want to buy a micro you must plan to use for two or three years.

Why did you publish such a load of rubbish? The market is confused enough without Lionel Moon's ravings.

D Saunderson,
KGB Micros Ltd,
Windsor,
Berkshire.

Illogical twaddle

RARELY, if ever, have I seen such a lot of illogical twaddle in an otherwise high-quality journal as January's Last Word by Danielle Bernstein.

I do not doubt that her basic premise is correct. Micro adverts are sexist; so too are most others. Her selected examples and style of writing do little to substantiate her case and instead reveal far more about her own prejudices. To cite a few examples:

- I have checked several newsagents for the display of magazines and cannot find any consistent evidence for her assertions.

(continued on next page)

(continued from previous page)

- She tells us that the word "mistress" does not, at first, suggest to her the oposite of "master". It does to me. This statement serves only to reveal her preconceptions.
- She says that Virgin Games is so named as to deliberately degrade women. What about all the other meanings of the word; especially as an adjective? The fact that the company sells games to boys is irrelevant to her contention.
- Her most amazing claims concern the Acorn advertisements. She tells us that "the stereotype is that men are supposed to co-operate while women compete". What would she have told us if the pictures had been reversed? Probably that "the stereotype is that men are assertive and dominant while women are shown in a supportive role".

Danielle may have a point but she cannot prove it by regurgitating a lot of unsubstantiated half truths. The available information should provide ample evidence for a more academically sound analysis.

Peter Amey,
Salisbury,
Wiltshire.

Computer ignorance

I WOULD like to reply to Danielle Bernstein, "The invisible woman", *Practical Computing* January issue. I think the advertisers are seeing the market realistically — the woman is almost invisible. The computer industry was growing up at the same time as women's rights and women had as much chance as men to become a part of that industry. However, many women did not take this opportunity, so men are still the decision makers.

I recently went to a computer fair (ugh) where most of the schoolgirls seemed more interested in congregating in the toilets to smoke while the boys played with the computers. The so-called experts on the stands were mostly men while the women handed out leaflets.

I have also been to business computer exhibitions and seminars where women were very much in the minority. On these occasions men carefully explained to me in words of one syllable how word processors worked but generally handed out leaflets when I asked about spreadsheets and accounting packages etc. On one memorable occasion a representative on a stand was spending a lot of time explaining to two men how a particular spreadsheet worked while another representative said that they only had an automatic demonstration and proceeded to read a pamphlet to me.

I feel that it is not until more women get themselves into the computing industry that this situation will change — but women are their own worst enemies. While talking to a friend recently on the telephone I mentioned that when I had finished talking to her I was going to spend some time on our home computer. She said, "Oh, I haven't got time to play games". Who's playing? Whilst in full-time employment I worked in a large computing department and am now trying to start my own computer-based company. So until more women show an interest in computers they are going to be treated as computer-ignorant, because that is exactly what they are.

Christine E Argyle,
Mijdrecht,
Netherlands.

Commodore 64 compatibility

I WOULD BE SORRY if potential buyers of the Commodore 64 were put off by the write-up in the November issue of *Practical Computing*, especially by the statement that the Basic "is incompatible with all others, including Commodore ones".

I bought a Commodore 64 simply because programs are very largely interchangeable between the 64 and the 8032 which I use at work. The only problem I have found is with Peeks and Pokes, but these I use rarely, and it is a simple matter to write a routine which asks "Is the computer a 64?", and then sets variables for the numbers accordingly.

A program saved on tape from the 8032 loads and runs without difficulty on the 64. When running a program saved from the 64 into the 8032, there is a slight difficulty in that it is loaded starting at address 2049 when the 8032 expects to find it at 1025. My system is to power up the 8032, type 0 Rem followed by Return, and then load the program from tape. Next, I enter the monitor by typing Sys4, which gives me a display as in figure 1. I display the contents of the start of the Basic program by typing m 0401 0401, and get the display in figure 2, which shows a link to two zero bytes, indicating end of program. Using the cursor controls, I alter the first two numbers to 01 08, not forgetting to press Return, and finally type x followed by Return to get back into Basic — see figure 3. The program is then listed, line 0 is edited out, and the program runs perfectly.

Figure 1.

```
*** commodore basic 4.0 ***

 31743 bytes free
b*
      pc  irq  sr ac xr yr sp
.;  0005 e44f 30 00 5e 04 f8
.
```

Figure 2.

```
*** commodore basic 4.0 ***

 31743 bytes free
b*
      pc  irq  sr ac xr yr sp
.;  0005 e44f 30 00 5e 04 f8
.m 0401 0401
.:  0401 07 04 00 00 8f 00 00 00
.
```

Figure 3.

```
*** commodore basic 4.0 ***

 31743 bytes free
b*
      pc  irq  sr ac xr yr sp
.;  0005 e44f 30 00 5e 04 f8
.m 0401 0401
.:  0401 01 08 00 00 8f 00 00 00
.x
ready.
```

To me, one of the best points about the 64, as with the 8032, is the ease of editing lines. If only other manufacturers would use an editor so user-friendly.

R Pidgeon,
Wotton under Edge,
Gloucestershire.

BBC software

IN YOUR review of BBC software — September 1983, page 138 — you state that for most versions of the game, extra lives may be obtained by adding the line

```
42 ? & FDD = 6
```

where 6 is the number of lives you want. Users of the old version of Snapper — that is, the one with ghosts instead of the goggle-eyed Martians shown on page 135 — will have found that this produces a very odd effect.

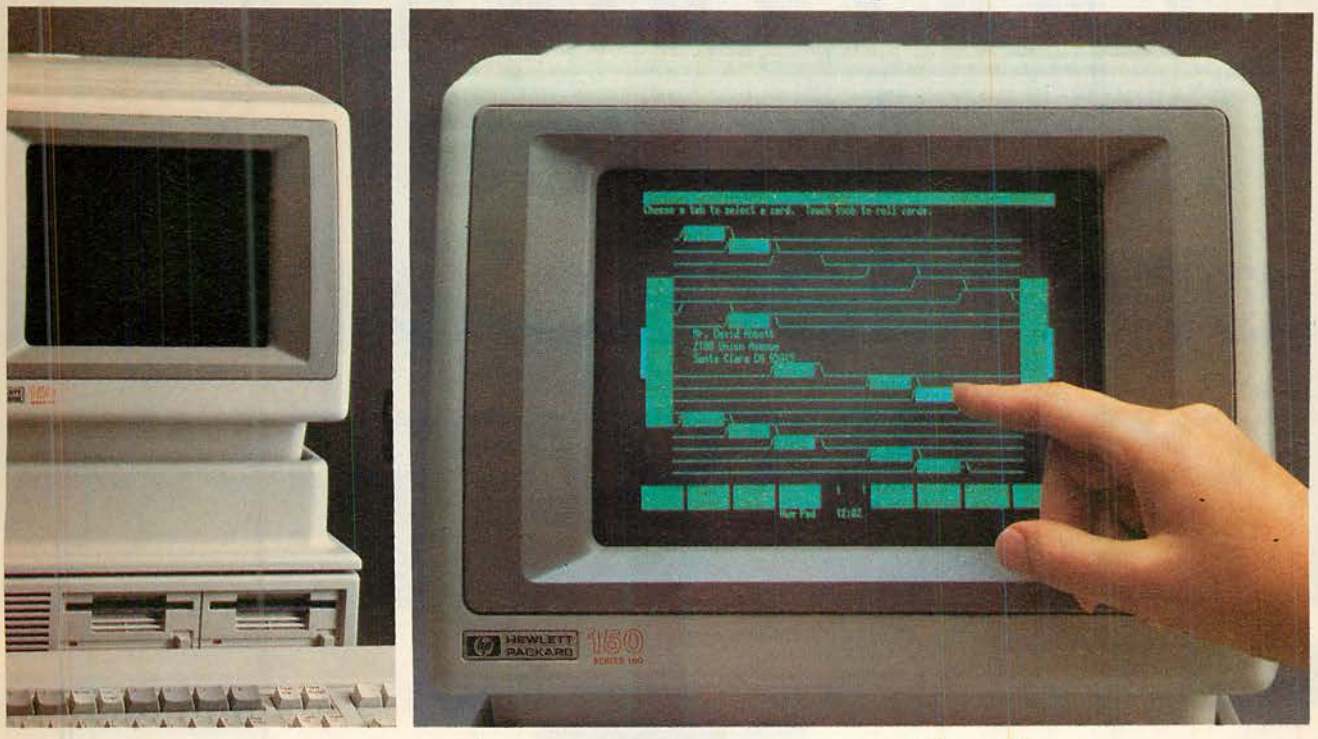
The correct line for this version is

```
42 ? &FD1 = 6
```

The maximum number of lives obtainable by this method appears to be 128, which should be enough for anyone to reach the mystic Acorn.

Angus J Rodger,
Monmouth,
Gwent.

It looks like any other personal computer.



Until you touch it.

The HP-150 Touchscreen personal computer. The most practical personal computer in the world.

Switch on. The unique, plain-language touchscreen tutor invites you to select the application you need. Choose the personal card file, for instance. Just touch the screen and remove your finger.

Then watch the high resolution screen for that address to unfold before your eyes – magically, effortlessly.

It's the same with editing. Point to the screen to move a whole paragraph or a single word on a letter or memo.

The action is so simple with touch, that mistakes are less likely than with the traditional keyboard operating systems.

For the first time, you can compose or revise your presentation documents without memorising complicated word-processing codes.

One touch will alter a forecast on the electronic spreadsheet analysis. Another will turn your figures into a pie or bar chart.

The HP-150 operates on the industry standard MS™/DOS*. So you have a wide range of proven software applications, including specialist business packages like graphics, accounting and integrated solutions.

And is there a keyboard? Of course. A full keyboard, designed also to give you the option of managing the HP-150 on keys alone.

You'll probably find our screen hard to resist, though. And we suspect that once you touch it, you'll never touch any other personal computer.

Get in touch on 0734 696622 ext. 4252.

HP 150 at a Glance.

User Memory:
256K-640K bytes.

Operating System:
MS-DOS 2.0.

Microprocessor:
16-bit, 8088, 8Mhz.

Permanent Memory:
(ROM) 160K bytes.

Diagnostics:
Power-on self-testing.

Display Screen:
Touch-activated,
green phosphor
80 characters x 27 lines
9 x 14 character matrix
Upper and lower case
Simultaneous text and graphics capability
390v x 512h graphics resolution
1024 characters and symbols in ROM

Keyboard:
107 keys, 8-ft. cord attaches to system unit, 10-key numeric pad, 12 function keys
(8 screen labelled)

Compact Size:
2.1 sq. ft. desk space

Communications:
2 RS-232 ports (Built-in)
HP-IB (IEEE-488) (Built-in)
IBM 3278 (SDLC, BSC), early 1984
Up to 19,200 bits per second

Peripherals:
Choice of printers (including optional internal printer), plotters, 3.5" floppy drives (264KB formatted), Winchester hard discs (5 and 15 MB).

*MS™/DOS is a trademark of Microsoft Corporation.

HEWLETT PACKARD

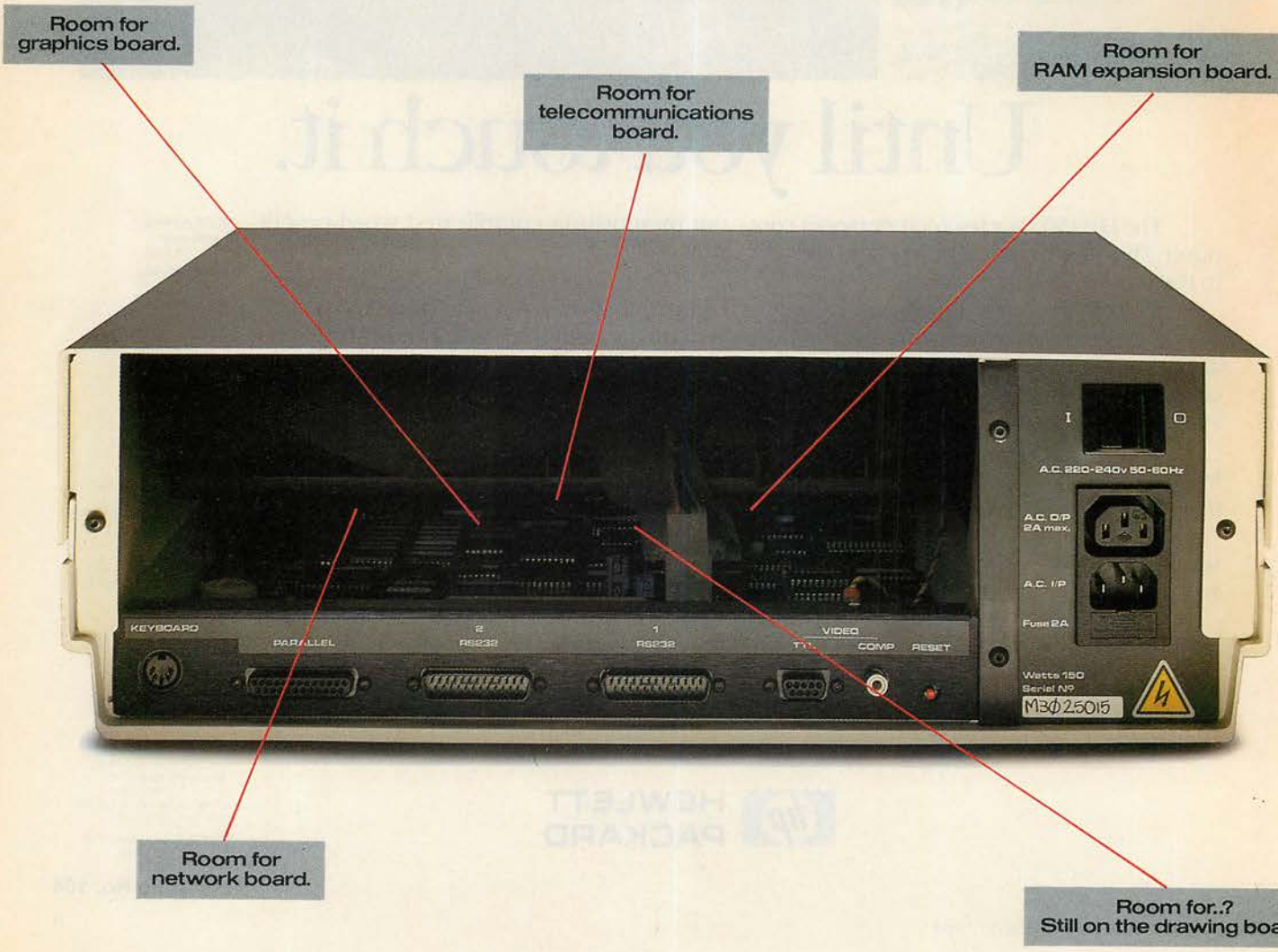
● Circle No. 104

Whatever computer you buy, it's bound to leave something to be desired.

But with the LSI Octopus, you can add just what you desire afterwards, merely by slotting a board in the back.

Even if you only come to realise you desire it years after you decide on the computer.

Our computer leaves considerable room for improvement.



More importantly, you'll be able to d facilities in the future which you can ly imagine today.

In the captions opposite are examples what the five option boards available re and now can offer you.

From simple memory expansion to e most sophisticated full-colour graphics.

But these are by no means the only tions open to you.

Your starter for £1500.

For around fifteen hundred pounds u can opt for an LSI Octopus system at simplest.

The central computer with one disc ve and a 109-key, fully-programmable yboard.

Any standard TV set can be used a monitor.

Even on this version we've included tures like direct memory access, colour d a real-time clock.

A couple of thousand pounds would y you a fully-fledged business computer tem, including two disc drives and a h resolution monochrome monitor.

For another thousand pounds or so, u could choose a system with the extra eed and capacity of a inchester drive.

Sooner or later, you'll nt to plug in more minals, so that more ople can use the mputer. Ultimately, u may even use an tion board to up a whole LSI topus network.

Free 'Axis'.

Though you'll need to plan for the future, here's a present we'll give you right away.

'Axis.'

Free with any but the most basic kit, it represents over a thousand pounds worth of software.

Capable of keeping your purchase, sales and nominal ledger, it would almost certainly be the first package you'd have to buy.

And like all our software, it's designed with the thought for detail that makes for real convenience and efficiency.

Software from elsewhere.

For more specialised tasks, there's plenty of business micro software on the market these days.

Virtually all of it is quite acceptable to our computer.

Including both the tried-and-tested 8-bit software and the 16-bit material that will offer the faster programming of the future.

Another instance of our leaving considerable room for improvement.

Please send me details of the LSI Octopus computer system.

Name _____

Position _____

Company _____

Address _____

_____ Postcode _____

Telephone _____

LSI OCTOPUS

The growing business computer.

LSI Computers, Copse Road, St. Johns, Woking, Surrey GU21 1FX.
Telephone 04862 23411 PC/5/84

● Circle No. 105

COMPSOFT

THE EVOLUTION OF DATABASE MAN

From the beginning of time man has been fascinated by his inability to solve even his simplest problems ...

As man's knowledge grew, so did his problems ... and so did his inability to solve them ...

And man's knowledge was vast. – And so were his problems. But he was no nearer solving them ...

From the beginning of **Delta**, man has been fascinated by his ability to solve even the most complicated problems quickly and effortlessly.

Delta is the most comprehensive and sophisticated database program on the market today. Faster and more powerful than ever before, Delta offers a unique 'three dimensional' file structure. Users can create their own records, sort, select, print reports, labels and print automatic personalised letters, do calculations, and link to other software including Lotus 123, Multiplan, Wordstar, Peachtext, etc. Users can design their own 'menu' of options, thus producing dedicated database systems. Delta is perfect for stock recording, personnel, parts files, clients records, brokers, libraries, Local Authority records, etc, etc, etc. Available for most business microcomputers with the PCDOS, MSDOS or CP/M operating systems, including the IBM PC, SIRIUS, APRICOT, XEROX, EPSON, WANG, and many more. Full colour guide, plus technical specification free on request on Guildford (0483) 898545.

DELTA

COMPSOFT DATA MANAGEMENT SYSTEM

COMPSOFT Ltd., Hallams Court, Shamley Green,
Nr. Guildford, Surrey GU4 8QZ, England.
Tel: Guildford (0483) 898545
Telex: 859210 CMPSFT

● Circle No. 106

Oric refurbished

ONCE UPON A TIME this magazine described the Oric as a "smashing little micro", while bemoaning the blippy keyboard and bug-ridden ROM. With the launch of the Oric Atmos 48K as a replacement for the Oric 48K, these problems have been corrected.

Oric has given the new model a real keyboard you can type on, a new Basic ROM, a new colour scheme and a very much smarter appearance all round. The Atmos is also claimed to run most of the original Oric software, but unfortunately it is somewhat more expensive at £170.

Oric's long-promised 3in. microfloppy disc drive, costing about £250 and holding 320K, is expected soon. When it does arrive Orice could well turn out to have a smashing little system, but at a price rather too close to that of a discounted Commodore 64 for comfort.

Contact Oric Product International at Cowarth Park, London Road, Ascot, Berkshire SL5 7SE.

Beyond Apple's Macintosh

APPLE'S NEW 68000-based office computer, named after a large variety of Californian apple, is previewed on page 88 of this issue. But the Macintosh's arrival alongside the Lisa does not mean Apple intends to abandon its eight-bit machines. To underline the point two new machines designed to plug into the Apple IIe Applesoft software base are in the pipeline. No firm details are available yet, but Apple is expected to reveal some of its plans at the Macintosh's official launch.

One machine will probably be a home micro for both work and play, along the lines of the Commodore 64. The other may be a portable. This would give Apple four eight-bit machines, with the IIe and III retained, all built around the 6502. A third advanced 16-bit machine is likely to join the Lisa and Macintosh.

Track-balls

TRACK-BALLS are the joysticks of the future according to Sirton Computer Systems. Control is effected by means of a partially hidden tracker ball suspended on a low-torque mechanism. Two-dimensional hand movements are converted into equivalent X and Y signals with fingertip precision.

Sirton's Track-Ball Cursor Unit is designed for use with any hardware fitted with a standard eight-bit parallel input. The price is £325, and further information can be obtained from Sirton Computer Systems Ltd. Telephone: 01-640 6931.

ITT Xtra

STC BUSINESS SYSTEMS Ltd has announced the ITT Xtra micro in the U.K. Claimed to be "operationally compatible" — whatever that means — with the IBM PC, this 8088-based system runs at 5MHz and has 128K RAM as standard. A typical system costs around £2,500 and a 10Mbyte hard-disc system just under £4,000.

Together with the parallel and serial ports, the floppy-disc controller is located on the motherboard, leaving five IBM-compatible expansion slots. The system is not, however, a complete IBM look-alike. Both the keyboard and main unit are considerably squatter in design, and the tilting and rotating monitor has a 14in. diagonal screen.

Further information can be obtained from STC Business Systems Ltd, Abbey Life House, 1-3 St Paul's Churchyard, London EC4M 8AR. Telephone: 01-236 9047.

Colex 16/32

THE COLEX 16/32 is a new portable based on the 80186 microprocessor running at a nifty 13MHz, and using a VME bus structure. The entry system offers 128K RAM, expandable to 256K; further expansion beyond 1Mbyte is possible via the bus. A 68000 card allows the MS-DOS operating system to be replaced by a multi-user Unix.

The 9in. amber screen allows 85 columns by 25 lines with a resolution of 640 by 440 pixels. The standard QWERTY keyboard has 15 function keys. The system with a single 720K 5.25in. floppy and 10Mbyte Winchester will cost around £3,500.

Information from Colex (U.K.) Ltd on (0990) 23377.

Commodore

IN AMERICA Commodore has unveiled the Triple Four, said to be "more than a games

(continued on page 15)

Shorts

Televideo has announced a hard-disc computer, the Tele-XT and the TPC II, a portable version of the IBMulator Tele-PC. No details yet about U.K. releases.

Hewlett-Packard's HP-86B is available in the U.K. through Rapid Recall Ltd. This upgraded version of the HP-86A has 128K RAM as standard and a built-in HP-IB, which is essentially a superset of the IEEE bus. The price has dropped too — to £1,194.72 precisely, plus VAT. Contact Rapid Recall Ltd on (0494) 26271.

Vector 4-S is the latest version of the Vector 4. It is claimed now to be able to read IBM PC and other soft-sectored discs. The entry price is about £2,500. Information on (07535) 69375.

Cambridge Microprocessor Systems has developed a 6809 processor board for the BBC Micro. It is aimed mainly at engineering applications. For £249, the second-processor unit comes with a Tube interface.CMS is on (0223) 276791.

Chubb's compact fire-protection cabinet, specially designed for floppy discs, can withstand temperatures of over 1,000°C. The cost is £450 plus VAT. For details telephone 01-637 2377.

● Circle No. 110

The Flagship...

In keeping with a long tradition of producing fine quality dot matrix printers, Epson have now launched their new flagship. The LQ-1500 is a new breed of printer, that will give you the best of both worlds. A dot matrix printer, although capable of 200 CPS in draft mode, can be set to produce letter quality at 66 CPS by simply flicking a switch.

Like all Epson products, versatility has been a primary consideration of the LQ-1500, incorporating friction feed as standard with optional tractor and hopper feed and a carriage width of a full 15".

You now have at your fingertips all the advantages of a daisywheel machine, in terms of quality, together with the added benefits of condensed or enlarged characters and proportional spacing, plus very high speed when set to operate in draft form.

Having superb graphics capabilities and optional 8-bit parallel (Centronics) RS 232 and 1EEE interfaces, the LQ-1500 has taken its rightful place at the head of the Epson fleet of fine dot matrix printers.

Epson have been leading the field in the design and production of printers for many years. Printers that are now successfully operating in all kinds of business environments, like the ever popular RX-80 and FX-80. With speeds of 100 CPS and 160 CPS respectively, dot addressable graphics and optiona tractor feed available on the FX model, these two machines are extremely reliable and widely used.

The RX-80F/T has the same

How to turn a BBC Micro into 14 lab technicians. For only £325.

As if the BBC Micro weren't already famous for its versatility, we've now taken it a step further.

14 ways to control science.

With the simple, and remarkably inexpensive addition of the Acorn IEEE Interface, the BBC Micro can control, manage and exchange data with up to 14 separate devices compatible with the IEEE 488 standard.

Which means you get the speed, accuracy and repeatability of computer-controlled operations at a fraction of the price of other systems. And without sacrificing the IEEE 488 standard.

The possibilities are limitless. The peripherals can range from a simple printer or a digital voltmeter to oscilloscopes, logic analysers, spectrum analysers, function generators, frequency meters – even a complete configuration of multiple controllers and complex equipment.

The Interface is familiar.

A Read Only Memory plugs into one of the Micro's spare ROM slots, providing the Interface Filing System, a set of commands in plain English, and in the straightforward format already familiar to those who know the Micro. (Commands can be incorporated in any language available on the BBC Micro, including the popular BBC Basic.)

More facilities.

But the BBC Micro/IEEE Interface combination gives you more than just control.

Thanks to its renowned graphics capabilities, it provides the ideal way to present experimental results in an instantly understandable form. A second processor can be connected for even faster processing and greater memory capacity. Or the Micro can be linked into Acorn's Econet local area network.

And even more.

And with its additional 1 MHz Bus connection, the Interface can even be linked to other interfaces, including Acorn's Teletext adaptor.

Finally, because the Interface operates independently, the BBC Micro is free to perform all its other functions as well.

So you can take advantage of the ready-made programs covering education and business subjects. You can use it as a word processor. Add a disc drive. And that's only the beginning.

How to get yours.

The IEEE Interface costs just £325, matches the BBC Micro in colour and profile, and comes complete with integral power supply and file server ROM.

If you're a credit card holder, you can order the IEEE by ringing 01-200 0200 anytime. Or 0933 79300 during office hours. (By ringing the same number, you can get the address of your nearest stockist, or full details of the BBC Microcomputer system if you don't already have one.)

Alternatively, you can order the package by sending the order form below to: Acorn Computers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.

Please allow 28 days for delivery.

Credit card holders, telephone 01-200 0200 anytime, or 0933 79300 office hours.

Technical Specifications.

PCB carrying IEEE 488 bus interface circuitry, using TMS 9914 integrated circuit.
Internal power supply.
Height 70mm. Depth 350mm. Width 210mm. Weight 2.1kg.
Colour: BBC Computer cream.
Construction: Moulded top and bottom to match BBC Computer profile. ABS injection moulded plastic.
Power in: 240v, 50Hz, 3w.
Operating Temperature: 10° to 35°C.
Designed and manufactured to comply with BS415 Class 1 standard.

To: Acorn Computers, c/o Vector Marketing, PC3
Denington Estate, Wellingborough, Northants NN8 2RL.

Please send me _____ Acorn IEEE Interfaces at £325 each, incl. VAT and delivery. I enclose PO/cheque payable to Acorn Computers Limited Readers A/C or charge my credit card.

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Amex/Diners/Visa/Access (Delete)

Name _____

Address _____

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The Flagship...

In keeping with a long tradition of producing fine quality dot matrix printers, Epson have now launched their new flagship. The LQ-1500 is a new breed of printer, that will give you the best of both worlds. A dot matrix printer, although capable of 200 CPS in draft mode, can be set to produce letter quality at 66 CPS by simply flicking a switch.

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The RX-80F/T has the same

The Fleet

dvanced features as the RX-80 ut having both friction and tractor eed as standard, it's a totally versa- ile machine at a thoroughly realistic rice.

With an ever watchful eye on the hanging face of the printer market, Epson have identified a growing need for a high speed printer with he ability to accept wider paper. Thus was born the FX-100, again ncluding all the advantages of its predecessors.

Epson are always looking for ways to improve products, a policy which has kept us one step ahead during a lifetime of being the first name in printers.

Fill in the coupon now to find out which member of the Epson printer family meets your requirements.

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Extraordinary product.
Exceptional quality.

Epson (UK) Limited, Freepost, Wembley, Middlesex HA9 6BR.
Sales Enquiries: Freefone EPSON.
General Enquiries: 01-902 8892.
Telex: 8814169.

☐ I would like a demonstration of the LQ-1500 printer.
☐ Please send me details of my local stockist.
☐ Please send me details of the range of Epson printers.

Name _____
Position _____
Company _____
Address _____
_____
_____ Tel: _____

PC3/DMP

● Circle No. 111

SOFTWARE AND TECHNOLOGY 4

A disk for every micro. While 8-bit micro-computers may boast a 'standard' operating system, one of its gravest shortcomings has been the lack of a common disk format. It has meant that data created with the same software package but on different computers could not be moved from one machine to another running the same operating system. With 16-bit micros running MS-DOS, this situation has been remedied. MS-DOS uses one data format common across all machines. This means that files from Multiplan or documents from Microsoft Word are completely transferable between any MS-DOS micros.

Enhancing high-level languages. Today's computer hardware offers a staggering array of new facilities, particularly where graphics and sound are concerned. As hardware develops, software writers have a choice between buying a special package just to achieve the most rudimentary on-screen graphics or music, or using a high-level language with built-in graphics and music commands. In fact, it would be foolish to expect proven languages like BASIC not to evolve as hardware becomes more sophisticated. With the latest version of its GW BASIC Interpreter, Microsoft has enhanced BASIC one step further for this new hardware. The language has a large number of graphics and sound extensions supporting new input devices such as joysticks and light pens, with graphics commands that can rotate defined objects at will on the screen, and the ability to open windows and see objects shrink or expand automatically as window sizes alter. The combination of advanced hardware and software like GW BASIC means that programs written in Interpretive BASIC can now run at speeds approaching those of programs written in lower-level languages. Features of this type would have been unheard of two years ago – but just think what sort of facilities may be available in tomorrow's high-level languages.

Europe's leading Financial Planning package. Even though the European Economic Community sometimes finds it hard to agree just who pays how much to whom and for what, it has at least reached a firm decision on one aspect of financial planning. When it comes to spreadsheets there appears to be great accord between France, Germany and the UK. Microsoft's Multiplan, translated to work in the natural languages of those countries has come out as the number one European spreadsheet package. According to a recent European survey in one of the monthly computer journals, Multiplan has emerged as the favourite spreadsheet. Microsoft has brought the same linguistic resources to bear on Word, its text processing package, and hopes that in 1984 Word will achieve the same international success as Multiplan.

How does a standard evolve? The microcomputer industry has traditionally established its standards by two routes. The S-100 bus, MS-DOS and 8-bit CP/M evolved while some manufacturers have consciously attempted to set standards as with the Ethernet network and the 3.5" Winchester disk format, hoping that others will follow in their footsteps. There has, however, recently been a new approach. At the end of 1983, an unprecedented commitment was made by 23 of the industry's leading microcomputer manufacturers to a new product from Microsoft. The product was Microsoft Windows – an enhancement to the MS-DOS operating system. Never before in microcomputing history has such a forceful public committment been made to one product. Companies like DEC, Wang, Tandy, Apple/Rana, Altos, NCR, Compaq, TeleVideo and Eagle will all be offering the product on their MS-DOS based micros in 1984. More recently, the UK's leading 16-bit microcomputer manufacturer, ACT announced that it too, would be supporting Windows on the hugely successful Apricot. By mid-1984 we will be reaping the benefits that such standardisation offers – portable software running in the same manner on different machines; integrated software with different applications running together on the same machines; and software that's a whole lot easier to use.

MICROSOFT

Microsoft Ltd, Piper House,
Hatch Lane, Windsor, Berkshire.

● **Circle No. 112**

Zilog to put CP/M on chip

TWO CHIP MANUFACTURERS, Zilog Corporation and American Microcomputers Inc., have reached an agreement with Digital Research to incorporate DR's Personal CP/M in a single-chip operating-system processor.

AMI will design the chip, which will then be manufactured and marketed by both AMI and Zilog. Development is expected to be swift — Digital Research expects products incorporating the new processor to be available to users within six months.

The new processor will be based on Zilog's eight-bit Z-80, with Personal CP/M actually contained in the chip's on-board ROM. This brings big advantages for hardware manufacturers, allowing powerful computers to be designed with fewer components and produced at greatly reduced cost.

Personal CP/M is an extension of CP/M 2.2, with help screens, visual prompts and other user-friendly features. It is compatible with earlier eight-bit versions of CP/M. The development of the new chip promises to open up the huge CP/M software base to users of a new generation of cheap home computers.

Acorn cassette-to-disc copying

HAVING TAKEN *PCW* to the High Court to discourage people from copying its BBC cassette software across to disc, Acornsoft is now offering a cassette-disc exchange service itself — at a price, of course.

The scheme works like this. If you already own an Acornsoft program on cassette the company will sell you a disc copy of the same title for half the normal price; you also have to send in your cassette. So having bought Starship Command, for example, at £9.95 on cassette, you can send it off, together with another £5.75, and Acornsoft will send you a Starship Command disc.

In effect BBC users face large software-conversion costs when they upgrade their systems, if they go along with Acornsoft's game. But most computer companies do not attach such significance to the physical medium on which a program resides. Most business software, for instance, is distributed on floppy disc and then copied across to hard disc for actual use. The purchaser is, in effect, buying the right to use the software on a particular system.

If Acorn's rivals in the home-computer business make a point of publicly adopting the policy of allowing users freely to convert their software as they upgrade their systems, the BBC Micro will be at a clear commercial disadvantage. Sales of disc drives for the BBC Micro may suffer, and eventually the computer itself may be hit.

For details of the Disc Replacement Service contact Acornsoft Ltd, 4a Market Hill, Cambridge CB2 3NJ.

Keydraw

KEYDRAW for the ACT Sirius lets you prepare reports where text is mixed with charts. Flow charts, organisational diagrams, pie, bar and other types of chart can be produced, and text added.

Keydraw requires a Sirius with 256K to run and an Actwriter, C Itoh or similar dot-matrix printer. The price is £250.

Details from Tarot Ltd, Tarot House, 16 Worbeck Road, London SE20 7SW. Telephone: 01-650 2999.

BBC utilities from Beebug

BEEBUG, the independent BBC user group, is bringing out a range of practical utility and application programs for the BBC Micro.

Toolkit, price £27, is a set of utilities on an 8K EPROM for BBC Basic programmers. Among its facilities Toolkit has a full-screen program editor which lets you search and replace strings and selectively renumber specified program lines.

Spellcheck, costing £19, is a disc-based spelling checker which works with the popular Wordwise word processor. A version for View is promised too. Spellcheck's initial dictionary contains 5,000 words, and you can add up to 17,000 more on 40-track discs or 34,000 on 80-track discs.

Teletext Pack comes on disc at £12 or cassette at £10. It consists of two programs: a tutorial which explains how to use mode 7 graphics from Basic, and a Teletext editor. The editor lets you create mode 7 screens interactively, and it will then generate the appropriate Basic Print statements for inclusion in your programs.

Other Beebug program offerings include Machine Code Monitor, a database called Masterfile, a computer-aided design package and a graphics plotting utility.

Contact Beebug, PO Box 109, High Wycombe, Buckinghamshire HP11 2TD.

Magazine Index

THE MICRO USERS' YEARBOOK provides a comprehensive index to articles in the 10 leading U.K.

(continued on page 23)

In Brief

● A complete set of business accounting software to run on Unix machines has just been launched in the U.K. Written entirely in C, the integrated package is called Cintra. Individual modules for payroll, sales, purchase and nominal ledgers are available separately, with prices starting at £350. Details from Computer House, 172 New Bridge Street, Newcastle upon Tyne. Telephone: (0632) 617001.

● Royal Birkdale for the 48K Spectrum is a golfing simulation game which accurately re-creates the famous golf course. The price is £6.90. Contact Ocean Software Ltd. Telephone: 061-832 9143.

● Computers in Medicine is the subject of a video produced by the British Medical Association. Called *The Days after Tomorrow* it is aimed at doctors who are thinking of introducing a computer into their practice or hospital. A short leaflet is also available. Both are free to BMA members; a nominal charge is made to other doctors. Contact BMA Film Library, BMA House, Tavistock Square, London WC1H 9JP. Telephone: 01-387 4499.

● Infidel is a lavishly packaged adventure game for the IBM PC and the Apple II. It has you looking for a lost pyramid in the Egyptian desert. The Infidel game disc is accompanied by an ancient map, stationery from an Egyptian hotel and other bits and pieces help you solve the mystery. Planetfall is a similarly packaged game from the same authors, this time with an SF scenario. Each game costs £33.95 plus VAT from Pete and Pam Computers.

WIN

1st. **14" COLOUR TV with TELETEXT and FULL REMOTE CONTROL!**

2nd. **SHARP PC 1500 PORTABLE COMPUTER!**

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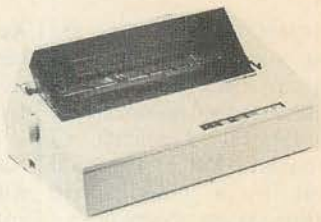

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● Circle No. 113

(continued from page 21)
microcomputer magazines. The 200-page loose-leaf file sets out to cover every article of substance of more than half a page, including hardware and software reviews and programming articles.

The current edition covers the period September 1982 to October 1983. Updates are to be published every six months. Three indexes allow you to access the information by general subject area, by computer name, or by one of 70 key words. We are already finding our copy useful for finding articles in our own back numbers.

The Micro Users' Yearbook costs £8, or £12 for the book plus two 1984 updates. Contact Computateam Consultants Ltd, White Court, Chilington Causeway, Tonbridge, Kent TN11 8LE. Telephone: Penshurst (0892) 870802.

Microdata's natural language

FIFTH-GENERATION computing comes a step closer with the launch of the first commercial natural-language environment. It involves the use of an interpreter called Natural Language, Microdata's Applications Language Liberator and Microdata's Pick-based relational database, called Reality.

The system allows you to query the database in your own words: "Show me all the bills," for example. Natural Language uses inference to try to work out what you mean, and if possible it produces something like a list of bills. Then it asks, "Was this what you wanted?" If stuck it will ask for synonyms for words it doesn't recognise, or to be allowed to ignore them, or offer a multiple-choice selection of options as a prompt.

The key thing is that it remembers what you tell it. In fact, it keeps a Personal Knowledge file of its users' idiosyncracies. Thus two people can use the same command, and the program may fetch two completely different sets of data.

All this means users can query the database in English without learning an elaborate computer language or syntax, or even getting the spelling right, since in cases of doubt the program makes an intelligent guess.

Microdata's M-1000 runs Natural Language software.

This is impressive stuff even on one of Microdata's 32-bit super-minicomputers. But now Microdata has launched the M-1000 work station — effectively a hard-disc based microcomputer. It uses an Intel 80186, has a better specification than the IBM PC XT and costs slightly less, though you still don't get much change out of £6,000. However, it runs the same software as Microdata's average £100,000 mini installation. Microdata is also planning to make the software available separately as Microreality for the IBM PC XT.

Microdata is essentially a British company, based in Hemel Hempstead, though it has been bought by McDonnell Douglas, the American aerospace corporation. It employs about 1,000 people in the U.K. and has an annual turnover of around £50 million. Users include an array of major names like American Express, the NatWest Bank, Texaco, BL, GEC, Thorn-EMI, British Telecom, Courtaulds and Unilever.

Contact Microdata at Maylands House, Maylands Avenue, Hemel Hempstead. Telephone: (0442) 61266.

Softsel awards mirror U.S. taste

ZAXXON was the hottest product of the year in America according to Softsel, a leading international software distributor. The game was awarded top prize in the company's annual Hot List awards for shooting to the top of the recreational section of the charts and staying there for 14 weeks.

Softsel distributes software to around 5,000 dealers in the U.S. and compiles weekly charts of its best selling programs for display in the computer stores. Separate charts are provided for recreational, business, education and other categories. Returns from the 450 dealers the company supplies in the U.K. were not taken into account for the 1983 awards.

Zaxxon is available in the States for the Apple, Atari, Commodore 64 and Tandy Color Computer. Though it was the year's most spectacular product, it did not get the best seller award in the recreational category. This honour belongs to Frogger from Sierra On-Line. Frogger runs on the Apple, Atari, IBM and Commodore 64, and clocked up greater sales by continually hovering around the top of the chart.

Best selling business program was Lotus 1-2-3, and as we go to press it is still at number 1, immediately above Bank Street Writer.

Best selling program in the educational category was Mastertype, running on the Apple, Atari, IBM and Commodore 64. It too is still at number 1, as is the best-selling book *Kids and the Apple* from Datamost.

International competition

A FIRST PRIZE of $100,000 is being offered in the International Video Game of the Year competition. The organisers are looking for games running on any popular home micro which embody original ideas. Copies will not be considered.

Prizes will be awarded in six categories — arcade, simulation, strategy, adventure, sport and other. Winning games will be marketed, with a 10 percent royalty going to the authors; reading the small print suggest the prizes are advances on these royalties. Apparently winners will receive their prizes on TV.

Details from Video Games International Ltd, Pinewood Studios, Iver Heath, Buckinghamshire SL0 0NH. Telephone: (0753) 651700.

Softerm 2 lets you use an Apple II Plus or IIe as a terminal connected to a host computer system. The program is claimed to let you run applications written for many popular terminals without any program changes being necessary. File operations can be performed in CP/M, Pascal and DOS 3.3 program formats. The price is £119 from Pete and Pam Computers.

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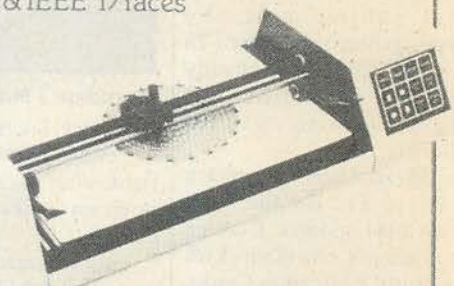

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Free software, only £225.

If you own a BBC Micro, you can now download, store and run programs (transmitted free of charge via Ceefax) with the new Teletext Adaptor, priced £225 inc. VAT.

These programs make up the BBC Telesoftware Service (which is intended to become a computer software broadcasting channel) and although primarily educational, they will soon develop into general interest and business areas.

And, as they will change every two weeks, you'll soon be able to build up a vast bank of top quality software without ever having to put your hand in your pocket.

But that's not all the adaptor has to offer. It also enables you to gain access to the normal teletext store of data. This is different to simply having a teletext TV because it means this data can now be transferred to memory and manipulated in any way you wish (making graphs or bar charts for instance).

It's yet another development in our programme to help you fully realise your BBC Micro's potential.

If you're a credit card holder you can order the Teletext Adaptor by ringing 01-200 0200 at any time or 0933-79300 during office hours.

(You can also find out the address of your local BBC Micro dealer by calling the same numbers.)

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PC3

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The MTX Series described; straight from the author's mouth

MANUAL

The first section (of the manual) is a basic tutorial. The grass roots information is here and I could not find any major mistakes. The second part is on Noddy giving a good guide as to how it can be written. . . . The third and fourth sections are on graphics and sound. Both are quite detailed and easy to follow. The fifth section is on how to interface Assembler to Basic.
Personal Computing Today Feb 84.

The provisional manual, which runs to some 250 A4 size pages, has a wealth of detail for the machine-code specialist.
Electronics and Computing Monthly.

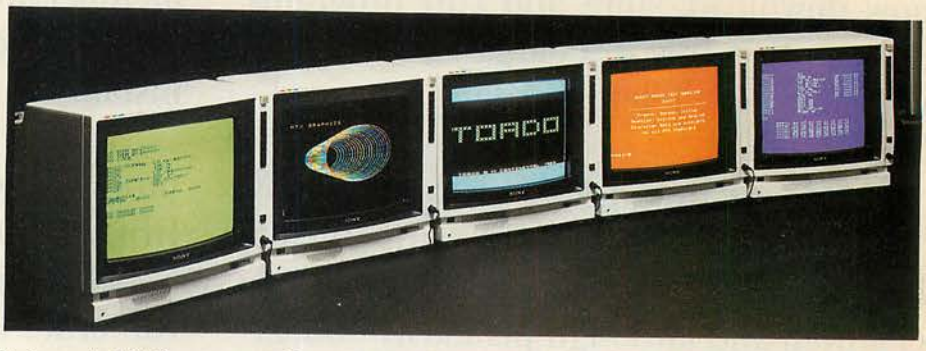
INTEGRATED INTERACTIVE SOFTWARE

The MTX ROM has been designed to allow the maximum interaction between components of the software. A single program can be written which uses NODDY to display text and graphics, and a BASIC control program which calls routines written in assembly code. This is a feature of future generation computers not available on any other micro.

BASIC

The Basic is fast and accurate, all the calculations being done in floating point maths, so that you don't lose accuracy to gain speed.
Personal Computing Today Feb 84.

The latest addition to the Memotech range DMX80 Matrix Printer – 80 characters per second print speed, eight character formats, dot addressable graphics, **£295.00 including VAT.**



Integrated Software – a five to one advantage. Assembler/Disassembler, High resolution Graphics, Arcade style games, Noddy for easy text handling and Front Panel for testing and debugging machine code.

NODDY

A language new to me called Noddy is included in the MTX which is designed to make text handling easy, especially for beginners.
Hobby Electronics.

Also provided is the easy to use beginner's language (Noddy) and a child oriented learning language Logo.
Practical Computing Dec 83.

(Noddy has only 11 commands) that need to be mastered before some quite complex question-and-answer-type programs can be written.
Your Computer Nov 83.

Noddy's . . . main use is for displaying text and I can see applications in the computer assisted learning (CAL) field. Writing in Noddy is like a mixture of Logo and Forth.
Personal Computing Today Feb 84.

ASSEMBLER/DISASSEMBLER

The Assembler can be accessed through BASIC. When used in conjunction with the PANEL it enables the programmer to single step through and test machine code programs. This is not new to computing, but it is to a home micro.

As well as being able to modify and disassemble sections of code, you can set break points, examine and alter register values, and even single step through code. I hope other Z80 micro manufacturers (particularly in the Cambridge direction) take note of these debugging aids.
Popular Computing Weekly Nov 83.

The Assembler is called from Basic, and it assembles the code in situ, as part of the Basic listing.
Hobby Electronics.

Z80 BOARD

The MTX Series is a more powerful tool for education than the 6502 because it produces a more powerful assembler, allows the PANEL function to be used, and enables integrated software to be written.

RML's 450Z has a (PANEL) function but that is a computer which costs considerably more than the MTX 500.
Hobby Electronics.

FULLY INTEGRATED AND EXTENDED GRAPHICS

The only aspect of the series where extensions to standard language are allowed is in the most comprehensive and integrated graphics available on a home micro.

32 Sprites are supported either 8 × 8 or 16 × 16. They are easy to use and define and do not use extra memory as in the BBC B because they have their own area of RAM.
Personal Computing Today Feb 84.

Graphics are very easy to create and manipulate, even for beginners.
Which Micro Jan 84.

MTX512 plus twin 5 1/4" disc **FDX**. A CP/M based business system – **£1245 inc VAT.**

SOUND

The simplification of the sound commands for ease of programming has in no way compromised the quality of the sound produced.

Sound is of great importance for use in games but on many microcomputers it is inadequate. Not so with the MTX . . .
Your Computer Nov 83.

As well as good graphics capability the MTX boasts the same sound chip as the BBC micro – the Texas 76489. It has three tone channels and one noise channel, and is easily controlled from Basic. Volume and frequency can also be controlled, using a much easier method than the 14 parameters needed by the BBC.
Popular Computing Weekly Nov 83.

The commands are sufficiently complex to enable the computer to be used as a synthesizer.
Electronics and Computing Monthly.

CP/M OPERATING SYSTEM

The Series is designed to run under the CP/M operating system. This is the Disc Filing System used on the vast majority of microcomputers in business. Since a program written on one CP/M machine can be transferred and run on almost any other, this makes available 15,000 CP/M based business programs. The powerful LINK program can give access to any device operating under CP/M. With its excellent software support and because of it's modular nature, the series is a cost-effective and efficient entry to serious business and educational computing.

FULL-TRAVEL KEYBOARD

It has a professional quality keyboard. This and its elegant styling make it suitable for word processing and business use.
Your Computer Nov 83.

Input/Output Monitor, Hi-Fi, Power, TV, Centronics, Cassette Mic and Ear, and two Joystick ports all come as standard; the twin RS232 ports are available as expansions.

HARDWARE

Inside the case is what one comes to expect from Memotech – a very neat PCB that holds all the components including the main chips – namely a Z80A processor and TMS 9929 graphics chips as well as about 30 others.
Popular Computing Weekly Nov 83.

If you are familiar with the ZX81 peripherals that Memotech also make you will know that the company has an eye for good design and does not skimp on materials it uses.
Electronics and Computing Monthly.

NODE RING

MTX computers can operate together without expensive network systems. Units linked via the ring can share software peripherals and communicate with each other. Many other makes of computer can be interfaced with the ring as terminals.

EDUCATIONAL USAGE

There will be many people who have seen a front panel display on the 380Z computer in secondary schools or colleges, and the MTX panel is very similar.
Hobby Electronics.

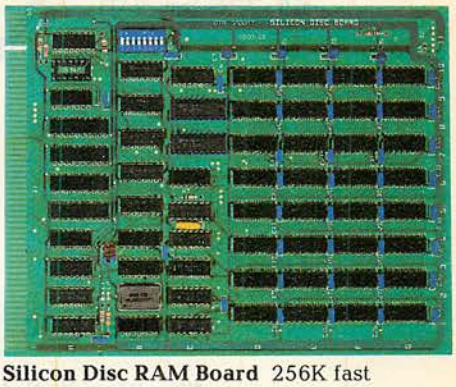
The new language Noddy and the Logo type Turtle Graphic commands would appeal particularly to the growing education market.
Your Computer Nov 83.

Applications are obviously going to suggest themselves in areas of the school curriculum, the fast-training of personnel in commerce, and in adventure-game writing.
Hobby Electronics.

The MTX expansion potential is well thought out. The key to both the MTX Ring system and to the Disc Drive systems is the communications (RS232) board mentioned earlier.
Electronics and Computing Monthly.

UPGRADABILITY

The MTX 500/512 is part of an existing range of products which can be bought separately and integrated into a single powerful system, now.



Silicon Disc RAM Board 256K fast access RAM

There is plenty of room for expansion with the MTX and Memotech have planned a progression up to their small business machine with 80 column display (instead of the standard 40 × 24) Floppy discs, Silicon (or RAM) discs, and a hard disc under development.
Personal Computing Today Feb 84.

There are a multitude of sockets along the back consisting of two Joystick sockets, cassette connections, Centronics printer circuit, aerial socket, power socket and audio and video output. There is also provision for two RS232 sockets . . . in addition the left hand end of the case has a large expansion socket with all the CPU signals on it – Memotech thoughtfully supply a plastic Blanking Plate to protect and conceal it when not in use.
Popular Computing Weekly Nov 83.

CP/M is a registered trademark of Digital Research Inc.

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● Circle No. 118

Software comes of age

Glyn Moody on the impact of software publishing on conventional publishers

IT IS A COMMONPLACE that the pattern of micro buying is now largely determined by the availability of systems and applications. Many a fine machine has died a death through being unable to support the operating system of the moment, or through not offering enough of the right packages. This state of affairs has come about through the specific way in which the micro market and its associated software has developed. The sheer size of the market has meant that its financial clout cannot be ignored, and the almost haphazard pattern of its growth has changed the structure of software buying and selling.

Home grown

Initially, hobbyist machines ran on almost exclusively home-grown software — indeed this was part of the original appeal of the micro. As micros became respectable, a new class of user evolved, who wanted ready-made programs as well as machines.

Two of the largest software houses around today sprang from a couple of these early programs that were in the right place at the right time. CP/M was designed in rather a hurry to provide a working operating system for the Z-80; and Digital Research now offers a panoply of operating systems, all extensions and enhancements of that one idea. Similarly, VisiCalc began life as a neat practical package for the Apple II; today the associated company Visicorp produces a range of related software. Like Topsy, these software houses "just growed".

Alongside the large corporations, there have always been a plethora of smaller software operations, usually based around some knowledge of Basic and two cassette players in the front room. These "one man and his dog" outfits have proliferated in the wake of the success of home machines such as the Spectrum and the BBC Micro. In between these extremes, there is a group of software publishers, ranging from Peachtree downward, who employ teams of experienced programmers to produce a range of application software for home and business consumers.

in software, the newer companies are often let down by their lack of marketing expertise and retail outlets. It is surprising that conventional book publishers who do have such expertise have until recently adopted a cautious attitude to the possibilities opened up by micros in software pubishing. Now, however, a number of major houses are edging gingerly into the market-place.

For some time popular publishers like Pan and Granada, together with a host of educational houses, have been producing books about computers, and books of program listings. Now Penguin has joined their ranks, with the announcement of a link up with Acornsoft to produce the Penguin Acornsoft Computer Library. Penguin hopes to move on to offer combined book and software packages before finally cutting the apron strings and producing software that can stand on its own merit.

Education is a common area for the first faltering steps by conventional publishers into software. The government schemes for micros in schools have prepared the ground and furnished a market. Conventional selling channels are readily adapted in what is a repackaging of earlier products. The material of an established educational book series often translates across easily into a software package. Whether this is the best approach is debatable since detailed programming skills are kept to a minimum and so are more easily overseen by editors without in-depth computer knowledge.

Primary educational software is a popular area for this, and in recent months Cambridge University Press, Longman and Macmillan have all announced software ranges. A significant shift is that these programs do not aim to teach computer studies or literacy as such, nor are they seen as a teacher substitute. They are conceived to be teacher aids and resources for conventional subjects — in other words, the software equivalent of books.

As far as the organisation of such new ventures is concerned, patterns vary. Heinemann Computers in Education was set up two years ago as a separate arm of Heinemann Educational Books. Other companies, like John Wiley and Sons and McGraw-Hill, have a more integrated approach, with book and software departments working together closely. For Cambridge University Press and Macmillan the scale of the operation is indicated by the production targets of about 50 programs a year; other companies are more conservative.

Exploitation

Some publishers are starting to exploit the particular strengths of their lists in areas other than education. For example, Oxford University Press is planning to launch three word-based packages in conjunction with Wang Computers: a speller based on the *Concise Oxford English Dictionary,* a quotations package and a style guide. Another interesting development involves daily newspapers, which have already increasingly diversified their publishing activities. The *Daily Mirror* has launched Mirrorsoft, a series of home computer programs, and the *Financial Times* has produced financial-modelling system.

In many ways these recent developments represent a coming of age for software publishing. The next step for publishing houses will be a move into applications software. The convenient tie-ups with current book lines and the security of tried-and-tested marketing pitches will be greatly reduced, and the risks correspondingly greater. But as advancing technology begins to impinge on the whole book-publishing process, publishers will find themselves more and more involved in providing products in a purely software format.

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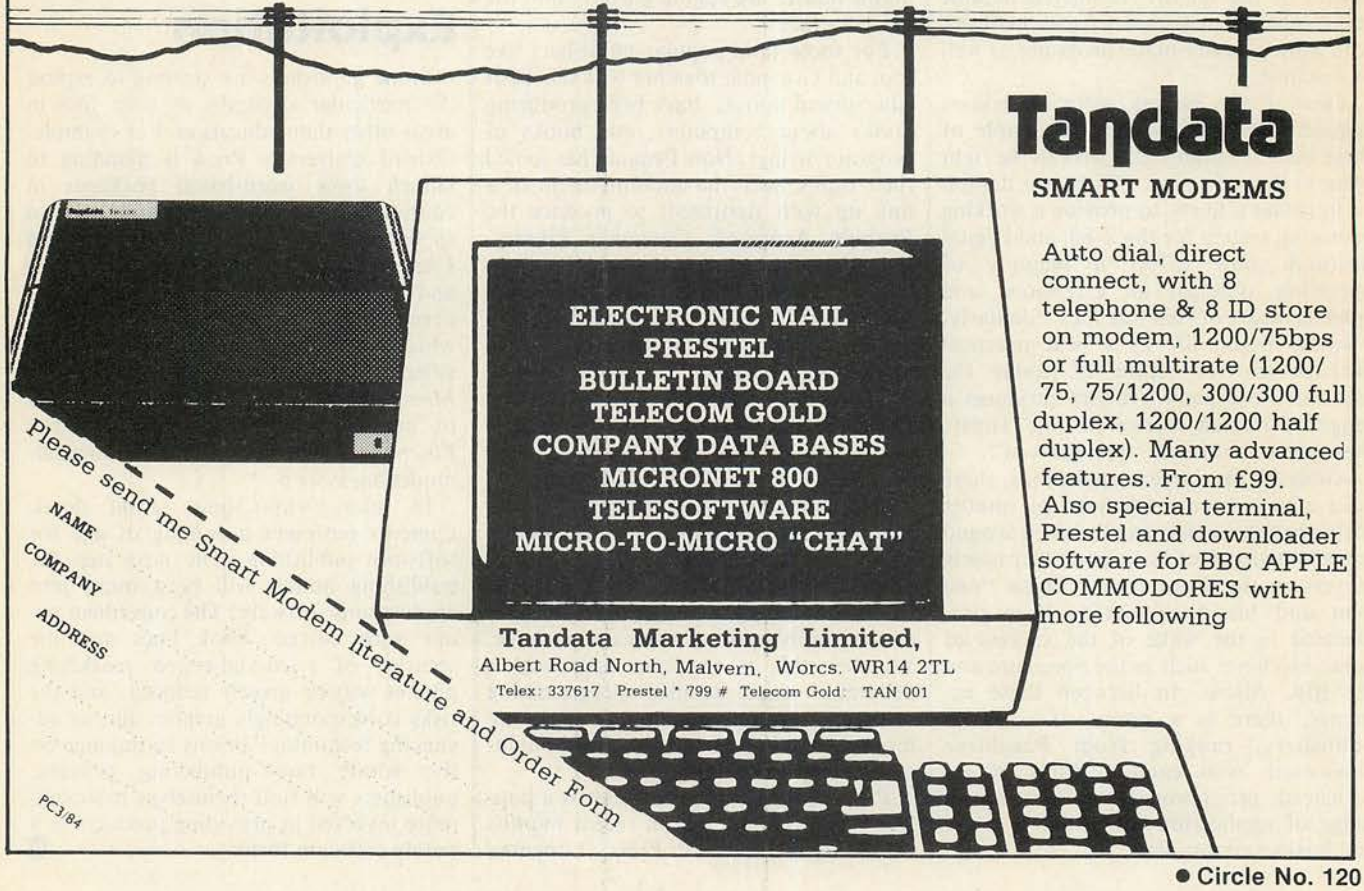
COMMUNICATIONS



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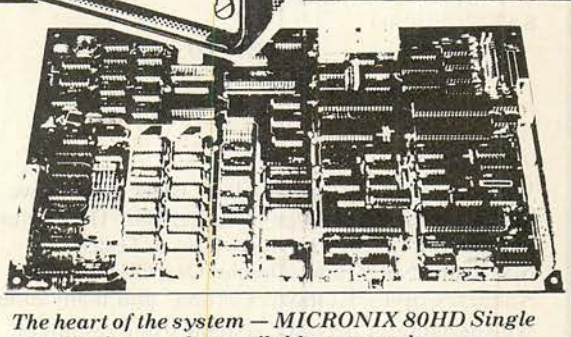

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Simply design your file, give its fields your words, setup your report mask, and then enter your records. Switch to 'automatic drive' and formulated any task you wish to program to fulfill, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disk will function without a single key-stroke. Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "analysis"; "patient history analysis"; "research-analysis"; "budgetting-analysis"; "vehicle-location control"; "librarian analysis"; "plus more?"

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G.W's price as a system
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AN IMPORTANT ANNOUNCEMENT FOR POTENTIAL SYSTEM BUYERS

Any serious buyer knows that although the HARDWARE and SOFTWARE are both inter-dependant, the choice of software is CRITICAL to the consequence of having useless piece of hardware nor not.
With this in mind our standard system deal gives you the software free with a system purchase. However, if you want more!

NOW we have a piece of software that is a challenge to the highest state of the art on micro-computers today. It's the first of its kind world-wide. It is called THE KEY, and it will unlock the power of your micro to the limits of your imagination. It is very expensive however, because it is the first to embody many features of other programs, in one single program that has over-lapping functions. It costs 995.00 Stg., and is available with a system purchase.

it features, the entire list of functions already covered by our program called DBMS III.7a to be seen elsewhere in our advertisement. PLUS. + + + + + + + +
Paint any form including upwards from 100 (depending upon size of ram in hardware) data fields on the screen. Screen width up to 250 columns. Page lengths 100 lines.

The form might be a letter where data fields on the screen. Screen width up to 250 columns. Page lengths 100 liens.

The form might be a letter where data fields are name-addresses. Search files and accept any fields on teh database into any fields on the letter. The form might be a spreadsheet, where searches call records (in columnated style) from the database and perform calculations, the difference here is that unlike other 'calc' programs giving you 254 lines per spreadsheet, THE KEY gives you 32000 lines if your database has that many records.

The standard attributes of any field, allow you to SEARCH OTHER FILES for fields to accept into any field on the current form, plus allowance to POST OTHER FILES any fields from the current form into any fields on that file. RELATE TO AS MANY OTHER FILES, as the number of data fields you have on the master form. Make data fields CALCULATE AGAINST FORMULAE, and other data fields. VALIDATE DATA INPUTS criticially character by character; numerically, alphabetically and date-wise.

NO MANUAL NEEDED, all help menues accessible by hitting 'esc' at any point in the three major modes of activity (create, data entry, data query).

You can set up dozens of individual files that eventually are inter-connected through one master form; like an invoice, order, personnel-file, stock control, mail-shot. The master form may at every juncture of a data field, go outside the current form to supplementary forms for data retrieval, or post-filing.
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Features. Design a form as wide as a window of 250 characters, long as needed. Cursor movements are 'left, right, up, down, delete left delete right, tab right-left-up-down' Paint your form as you like directly on the screen.

Text..... Write a letter as you see it on the screen, edit it then simply enter ^P to print.

Calc..... Set into the form, your data fields, ''£££££'' and specific file-related activities, formulae and validation checks.
Enter values and see the spreadsheet calculate itself.

Database. Search files for data to be inserted to fields specified.
All the features of DBMS III, explained elsewhere in our ad.

Here's an example of an invoice you might design for your stationery .....
You could design your own spreadsheet, order form, statement, or any other kind of form that is required to fit your existing stationery.

INVOICE <0>£££££££££££

To £<1>£££££££££££
£<2>£££££££££££££££
£<3>£££££££££££££££
£<4>£££££££££££
£<5>£££££££££

From: G.W. Ltd
55 Bedford Court Mans.
Bedford Avenue
London W.C.1.
Tel: 01-636 8210

Date <6>££.££ Tax point <7>££.££ Agent <8>£££

Quantity	Description	Cost	Tax	Total
<9>£££	<10>£££££££££££££	<11>££	<12>££	<13>£££
<14>££	<15>£££££££££££££	<16>££	<17>££	<18>£££

and so on...

Total...<19>£££££ Tax...<20>££££

<??> items <1 >to <5 >internal command to request name input, and then search an address file for details.
<??> items <6 >to <7 >request date input and validate.
<??> item <8 >request agent number and validate range.
<??> <9 >request quantity, validate range.
<??> <10>request description, search file, accept, and calculate fields <11>, <12>, <13>, if finished invoice then calculate fields <19> and <20>

Now comes the more valuable facility, you can provide the 'FORM' with file-related instructions, not only to request a 'console' input for a file search against names, and stock, but after the invoice is finished the fields you have selected may be passed to related files.

EG: Send fields <0 >, <1 >, <6 >, <7 >, <11>, <12>, <13>, <19>, <20> to a sales ledger.
Then send fields <9 >, <10>, <11>, to product analysis file.
Then send fields <0 >, <1 >, <7 >, <19>, <20> to V.A.T. file
Then send fields <10>, <11>, <12>, <13> to Nominal ledger.

Available at present only on SIRUS/IBM PC.

● Circle No. 122

If the number of computer systems on the market leaves you totally bewildered, we don't blame you.

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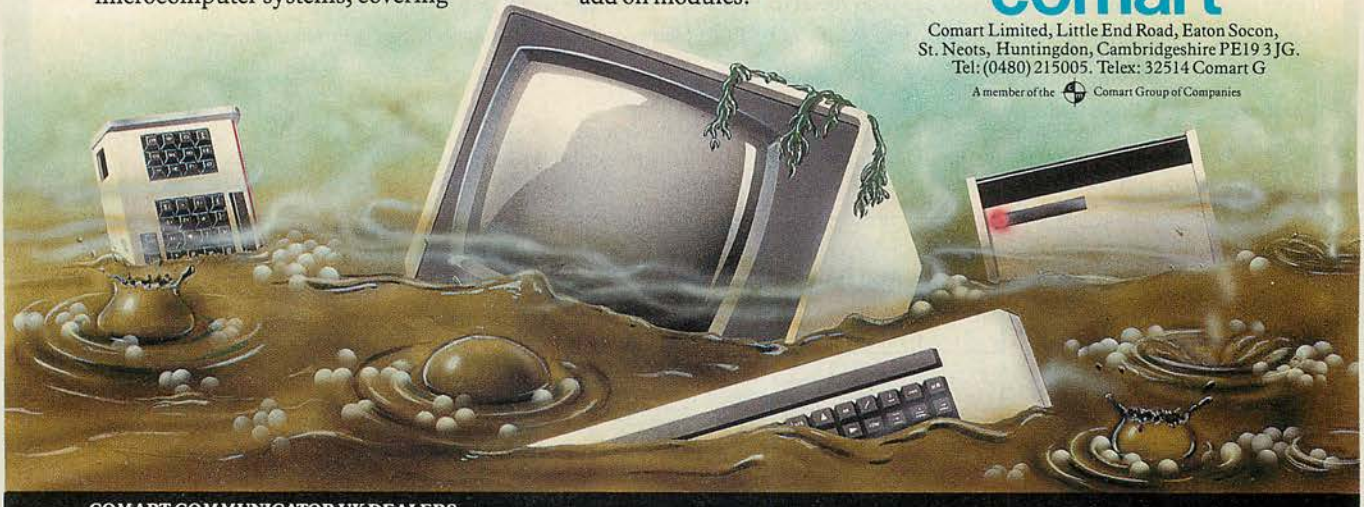

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● Circle No. 123

by Ray Coles

The big match

RECENTLY I RECEIVED in the post no less than five copies of the same edition of the Digital Equipment Corporation new products bulletin *DEC Update*. Like most other American computer manufacturers, DEC is well known for its generosity with data books and technical magazines. But five copies, of the same magazine does seem excessive. Clearly there had been a foul-up in the DEC mailing list database.

Closer inspection revealed that the mailing labels on the envelopes were all different. To a hyperintelligent mega-being such as our postman it was obvious that all the envelopes were intended for me, despite the misspelled name on one envelope, the wrong company name on another and the inclusion of an unnecessary street name on a third. The conclusion is simple: compared to our postman the DEC database program is a real dunce, blind to the glaring similarities shared by the five mailing labels. Surely, I reasoned, a garbage-collection program could easily spot these similarities and purge the database of unnecessary destinations.

A moment's reflection convinced me that it may not be that simple. The computer time required to search a database consisting of many thousands of addresses, each consisting of a hundred or more characters, looking not for direct duplicates but for mere similarities, may make it more cost-effective to send out the redundant magazines.

Inept computers

A similar example of the ineptitude of current computers when faced with recognising similarities in text strings appears, most annoyingly, when they respond via the keyboard to those user-friendly query or prompt messages displayed on the VDU. Well written software will at least recognise that Y means Yes and N means No. Raise the intellectual level of the man-machine interchange much above that of the average three-year-old and the chances are that the computer will respond with a user-friendly message such as ? or, in more advanced systems

REDO FROM START

Of course, it is possible to write computer routines which recognise that

I AM EIGHT

means the same as "8" in response to the question

HOW OLD ARE YOU, EARTHLING?

but to make such features universal is either too much trouble or too time consuming at run time. What is sorely needed is some sort of hardware that specialises in recognising similarities between text strings; our very fast but exceedingly dim central processor would then not have to check things out the hard way.

Thanks to Proximity Technology Inc. and its new PF-474 chip that need may soon be satisfied. Inside the 40-pin dual-in-line package of the PF-474 there is a single NMOS chip containing 45,000 active devices organised as the world's first intelligent string comparator. It is capable of comparing two strings of up to 127 characters each, reporting on the similarities that it finds by means of a 32-bit fraction which ranges in value from 0 for no similarities, to 1 for a perfect match. Even better, the PF-474 contains a ranking sub-system which keeps track of the 16 best matches it finds while the search continues. At the end of a database search the 16 closest strings can be recalled for further investigation or for modification.

Grey-matter CPU

Despite the undoubted abilities of the PF-474, it still can't compete with the average postman, who can actually understand the meaning of the text strings on the envelope. This facility allows the rapid assessment of similarities even by a very slow "grey-matter" CPU. The PF-474 operates purely statistically and makes no attempt at semantic analysis. This can sometimes be an advantage, especially if the strings are in code or in a foreign language, a situation which might put our postman into an infinite Do loop.

To programmers, the PF-474 appears to be a 1,024 byte region of memory split into four main blocks of 256 bytes each. The first block is the control section used to transfer control and status information concerning a search in progress. Next comes a parameter block organised as a look-up table which contains one byte of information for each of the 256 possible characters available in an eight-bit representation. For each character, three attribute parameters are stored: Weight, Bias, and Compensation. Every one of the possible characters can have individually established attribute parameters so that comparisons can be tuned to suit the application.

Third block

The third block is used to store the reference and current strings. The fourth block is used by the ranker for control purposes and to store the eight-byte entries in the ranked list. Four bytes denote similarity value; the other four contain the record number.

The parameter memory is used to vary the chip's notions of similarity by means of the character attribute values. The Weight attribute defines the importance of a particular character in a match, so spaces could be given a low weight while vowels might rate a higher weighting than consonants. The Bias attribute is used to add a directional preference to the comparison process. When bias is negative, a match at the start of a string will have more effect on the outcome than a match at the end, and vice versa for a positive bias. The third attribute, Compensation, allows trading off between two different types of dissimilarties, namely Permutation, or scrambling, and Content arising from insertions, deletions or changes. A low compensation value causes the PF-474 to ascribe less importance to variations in the position of a letter; a high compensation causes it to ascribe less importance to missing letters.

The programmer's ability to vary the terms on which the PF-474 computes similarity makes this device a great deal smarter than any achievable software implementation of a string-matching routine. It also enables the chip to be used with any eight-bit code, including straight numerical binary, not just ASCII. This in turn opens the door to the use of the PF-474 in a host of other pattern-recognition problems, such as image processing or speech recognition, for example.

Pipelined path

The PF-474 is fast. It takes only 75 microseconds to compare two 45-character strings, thanks to a pipelined computation path which is nine stages deep. This level of performance is at least an order of magnitude faster than anything which could be achieved on the best general-purpose microprocessor emulating the PF-474 algorithms in software. It can be increased still further by using multiple devices acting in parallel on separate areas of memory.

If, like me, you can't wait to get this sort of capability running on your own system then you may be in luck. Proximity Technology has designed PF-474 interface boards for the IBM PC and the Apple II, and also has the all important software divers available to go with them.

BUY AN apple™

In our Winter Sale

while stocks last

The Professional Home Solution

Apple IIe 64K
Disk Drive
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Includes over **£300** of extras

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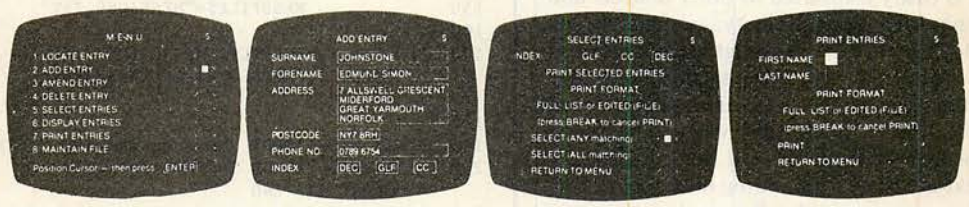

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● **Circle No. 245**

Putting the message across

This month Mike Lewis offers some tips on handling text for prompts and menus.

IF YOU have ever developed a large suite of programs, such as an accounting system or a payroll, you will have come across the problem of operator messages. Apart from the tedium of having to code scores of Print statements, the sheer bulk of text needed for menus, prompts, error messages and help screens threatens to swamp the programs.

A common solution is to hold all the messages on a direct-access disc file, to be read in as needed. But frequent disc accesses will slow down the program considerably. Ideally, you need to keep the most common messages in RAM, and the others on disc. The trouble is that often you have no way of knowing in advance which messages are going to be needed at which times.

Least used

The solution to this problem provides a good illustration of the least used/first discarded algorithm. This technique has many applications in programming. The basic idea is to store the most frequently used items in a buffer. As each new item — in this case, a message — enters the buffer, it pushes out the item that has been used the least often.

Here is what you do. First, set up a disc file containing all the messages that you are likely to need. Listing 1 shows an interactive program that will do this. The program is written in Microsoft Basic, but it is easily translated to other dialects and languages. For simplicity, assume that the messages are fixed in length. Each message is identified by a consecutive message number which is the same as its record key. The program will invite you to enter a message number. It will then display the text of the corresponding message, if any. You may press the Return key to retain this message, or enter a new text to replace it. To stop the process, enter X instead of the message number.

Separation helps

The beauty of this arrangement is that it keeps the messages separate from the application programs. You can enter the messages as you go along, and change them without having to alter your coding. Think how useful this would be if you ever wanted to bring out a foreign-language version of your software.

Listing 2 shows a separate program that will initialise a new message file, setting the entire text to spaces. This is not vital, but it will save garbage from creeping into the text the first time that you use the interactive update program.

In the programs that actually use the message file you will need a table to hold the more frequently used messages. In fact, you need two tables: one to hold the text itself and another for the corresponding message numbers. You will also need a subroutine, similar to the one shown in listing 3, line 5000.

Listing 1.

```
100 '*****      AN INTERACTIVE PROGRAM TO SET UP AND UPDATE THE
                 MESSAGES FILE
110 '
120 '***** CONSTANTS USED:
130              MAXMESS%=250                    'HIGHEST MESSAGE NUMBER
140              MESSLGTH%=32                    'MESSAGE LENGTH
150              MESSFILE$="MESSAGES.TXT"        'FILE NAME
160 '
170 OPEN "R",1,MESSFILE$,MESSLGTH%:
       FIELD 1, MESSLGTH% AS MESSBUFF$           'OPEN THE FILE AND ALLOCATE
                                                  A BUFFER FOR IT
180 '
190 PRINT: LINE INPUT "Message number? ", THISNO$
200 IF THISNO$="X" OR THISNO$="x" THEN
       CLOSE 1 : END                             'PROGRAM TERMINATES
210 IF VAL(THISNO$)<1 OR VAL(THISNO$)>MAXMESS% THEN
       PRINT: PRINT "Out of range" : GOTO 190    'INVALID MESSAGE NUMBER
220 THISNO%=VAL(THISNO$)
230 '
240 GET 1, THISNO%                               'READ EXISTING TEXT
250 '
260 PRINT       "Old message...   " ; MESSBUFF$
270 LINE INPUT  "New message...   " , THISMESS$
280 IF LEN(THISMESS$)>0 THEN
       LSET MESSBUFF$=THISMESS$: PUT 1, THISNO%
                                                 'REWRITE WITH NEW TEXT
290 GOTO 190
```

Listing 2.

```
100 '*****      PROGRAM TO INITIALISE A MESSAGE FILE
110 '*****      SETS ALL MESSAGE RECORDS TO SPACES
120 '*****
130 '
140 '***** CONSTANTS USED:
150              MAXMESS%=250                    'HIGHEST MESSAGE NUMBER
160              MESSLGTH%=32                    'MESSAGE LENGTH
170              MESSFILE$="MESSAGES.TXT"        'FILE NAME
180 '
190 OPEN "R",1,MESSFILE$,MESSLGTH%:
       FIELD 1,MESSLGTH% AS MESSBUFF$            'OPEN THE FILE AND ALLOCATE
                                                  A BUFFER FOR IT
200 LSET MESSBUFF$=" "                           'SET THE BUFFER TO SPACES
210 FOR J%=1 TO MAXMESS%:
       PUT 1, J%:
    NEXT J%                                      'FILL THE FILE WITH SPACES
220 CLOSE 1: END                                 'CLOSEDOWN
```

by Mike Lewis

You call this subroutine whenever you want to display a message. Set the message number in the appropriate variable, in this example

THISMESS%

The routine searches the message number table for the required code. If the code is not present, it reads the message from the disc file and puts it at the bottom of the table, overwriting what was there before.

After it has displayed the message, the subroutine swaps it with the one immediately before it in the table. It also swaps the message numbers. In this way, the messages that are used most often will trickle through to the top of the table, and the less common ones will tend to the bottom, where they will become eligible for overwriting by new items coming in.

This is a very efficient way of handling large amounts of text. The commoner messages can be fetched extremely quickly, and disc accessing is kept to a minimum. The extra coding needed will add very little to the overhead of your programs, and in most cases the whole process will be faster than the alternative: loading every message every time the program is run.

Length varies

Among the enhancements that you may wish to make to this technique is altering it to cater for variable-length messages. A simple way of doing this would be to make each message a multiple of the basic length. The first byte of each message should be used to indicate the number of such multiples used.

An important question is the size of the message table, which in the example is

LIMIT%

You have to balance the additional searching time needed for a large table against the reduced number of disc accesses. Your best best is to experiment until you find the best setting for your application.

Consider too the initial values of the table entries. The algorithm will work perfectly well if the table starts empty, but it will not reach full efficiency until it fills up. You may like to initialise the table so that it contains any messages that are likely to be needed at the start of the run — a sign-on message or copyright notice perhaps.

Listing 3.

```
1000 ''''       SKELETON OF A PROGRAM TO DEMONSTRATE THE USE
                OF A MESSAGES FILE.
1010 ''''
1020 ''''       THE PROGRAM CARRIES OUT THE NECESSARY INITIALISATION
                AND THEN DISPLAYS A MENU, THE TEXT OF WHICH IS HELD
                ON THE FILE AS MESSAGES 25 - 35.
1030 ''''
1040 ''''       THE ACTUAL MESSAGE HANDLING ROUTINE STARTS AT LINE 5000
1050 '


1060 '''' CONSTANTS USED:
1070            MESSLGTH%=32                    'MESSAGE LENGTH
1080            MESSFILE$="MESSAGES.TXT"        'MESSAGES FILE NAME
1090            LIMIT%=20                       'NUMBER OF ENTRIES IN TABLE
1100 '


1110 '''' INITIALISATION:
1115 '
1120 OPEN "R",1,MESSFILE$,MESSLGTH%:
       FIELD 1, MESSLGTH% AS MESSBUFF$          'OPEN THE MESSAGES FILE
1130 DIM TXT$(LIMIT%), MESSNO%(LIMIT%)          'ALLOCATE THE TWO TABLES
1140 '
1150 '


2000 '''' DISPLAY MENU:
2010 '
2020 FOR THISMESS%= 25 TO 35                    'THISMESS% CONTAINS REQUIRED
                                                 MESSAGE NUMBER
2030    PRINT                                   'DO A BLANK LINE BEFORE EACH
                                                 ACTUAL LINE OF TEXT
2040    GOSUB 5000                              'CALL THE MESSAGE ROUTINE TO
                                                 OUTPUT THE REQUIRED TEXT
2050 NEXT THISMESS%
2060 '
2070 '


5000 '''' MESSAGE-HANDLING ROUTINE:
5020 '    ON ENTRY, THISMESS% CONTAINS REQUIRED MESSAGE NUMBER
5030 '
5040 FOR J%=1 TO LIMIT%:
       IF MESSNO%(J%)=THISMESS% THEN
            MPOINT%=J%: GOTO 5070               'MESSAGE ALREADY IN TABLE
5050 NEXT J%
5060 GET 1, THISMESS%: MPOINT%=LIMIT%:
       MESSNO%(MPOINT%)=THISMESS%: TXT$(MPOINT%)=MESSBUFF$
                                                'MESSAGE NOT IN TABLE, SO
                                                 READ IF FROM DISK AND PUT AT
                                                 END OF TABLE
5070 PRINT TXT$(MPOINT%)                        'PRINT THE MESSAGE
5080 IF MPOINT%>1 THEN
       SWAP TXT$(MPOINT%), TXT$(MPOINT%-1):
       SWAP MESSNO%(MPOINT%), MESSNO%(MPOINT%-1)
                                                'MOVE MESSAGE UP ONE PLACE
5090 RETURN
```

Mailmerge speed-up

ONE OF the selling points of Micropro's WordStar package is its ability to print one document while you are editing another. This background printing does make the keyboard response sluggish, but you miss it when it is not available, and many people have wished it could be extended to merge-printing — that is, printing with Mailmerge.

Simultaneous printing and editing is possible with Mailmerge, after a fashion, although the technique is not described in the manual. It works like this. First, merge-print the document in the normal way, but answer Y when Mailmerge asks

DISK FILE OUTPUT?

Specify a suitable temporary file for the output. Mailmerge will write an image of the eventual printout on this temporary file, the whole process taking a fraction of the time needed to print to paper.

Next, print the temporary file using the normal print option, not merge-print. In this case, answer N to

DISK FILE OUTPUT?

but answer Y to

SUPPRESS PAGE FORMATTING

Your Mailmerge output will now go to the printer, during which time you may carry on editing. Finally, delete the temporary file.

However, there are a couple of snags. The process cannot handle certain dot commands, such as those for character width and line height, and you may need to re-enter these in the intermediate file. Also, micro-justification does not work, since all spaces will be "hard". But the biggest snag is the large amounts of extra disc space that this process will need. Whether it is worth it is for you to decide.

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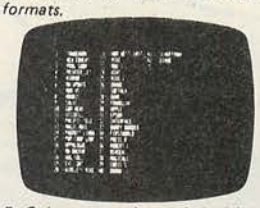

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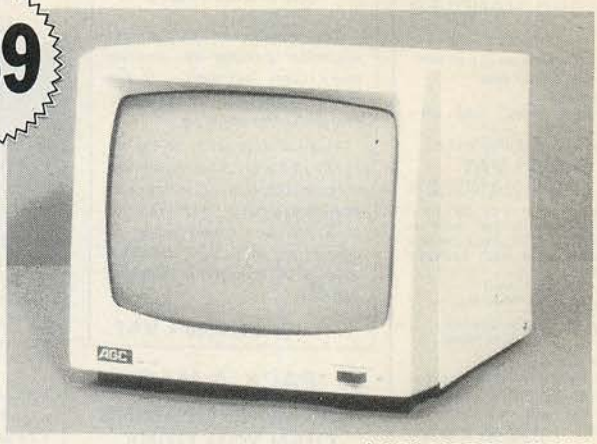

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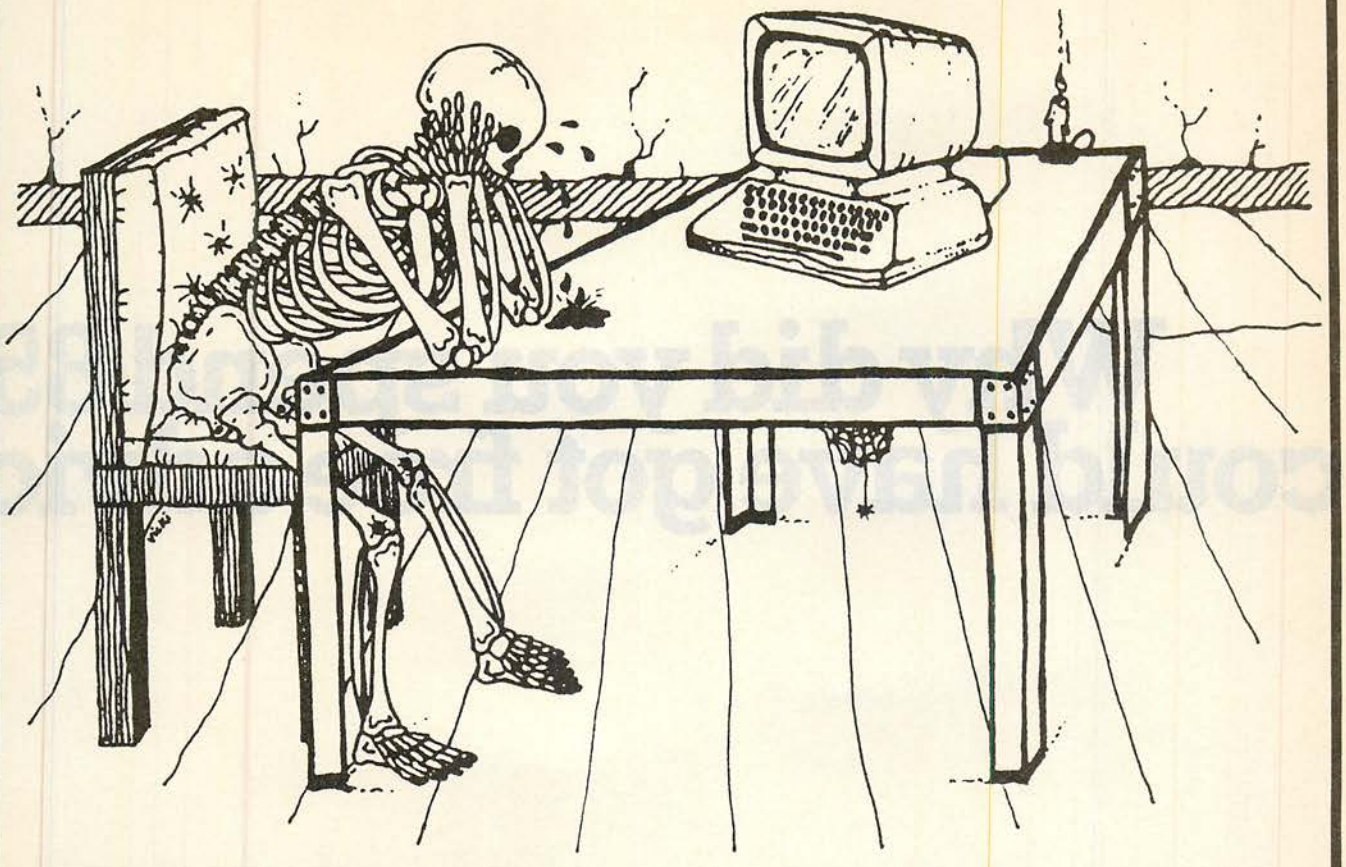

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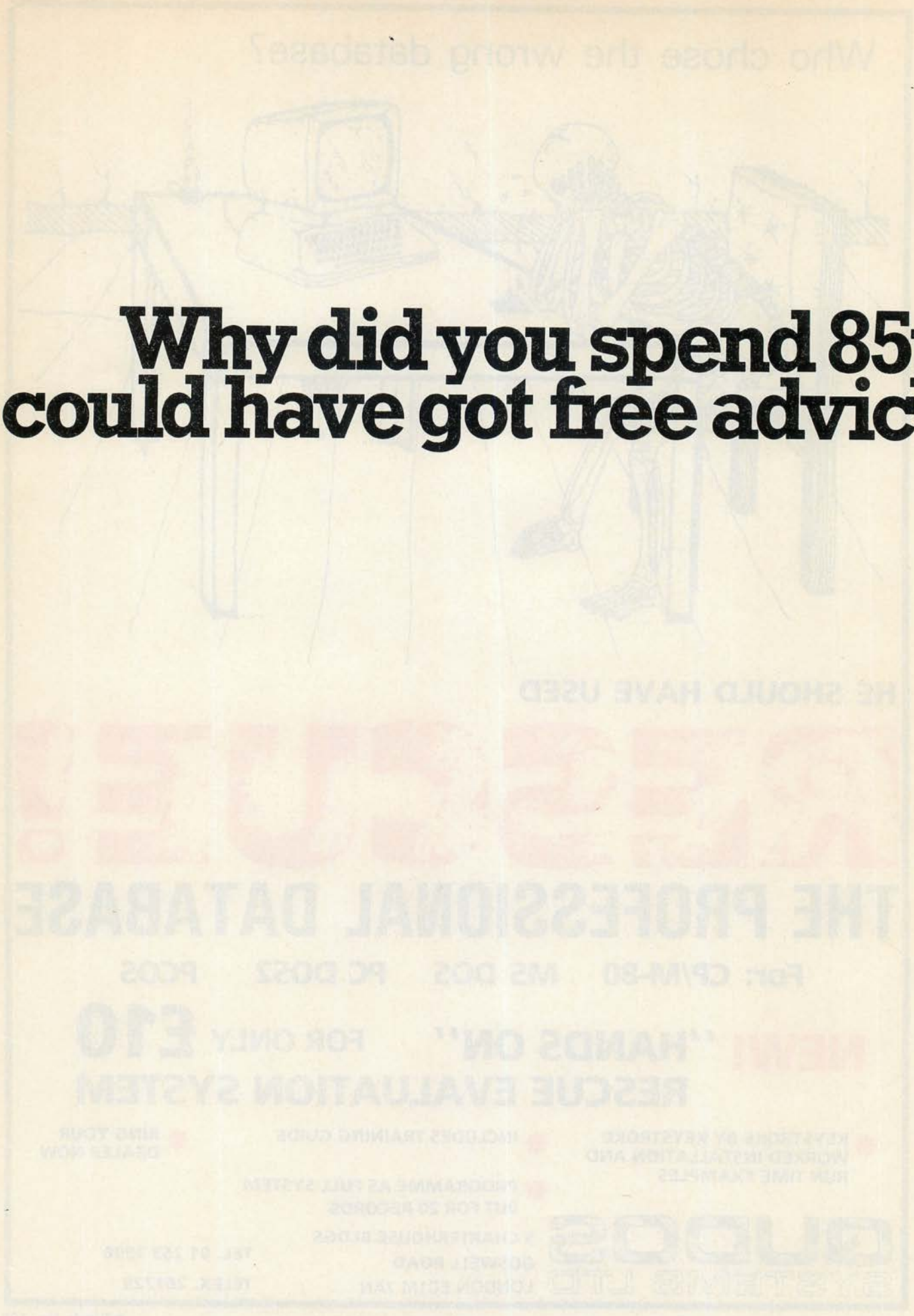

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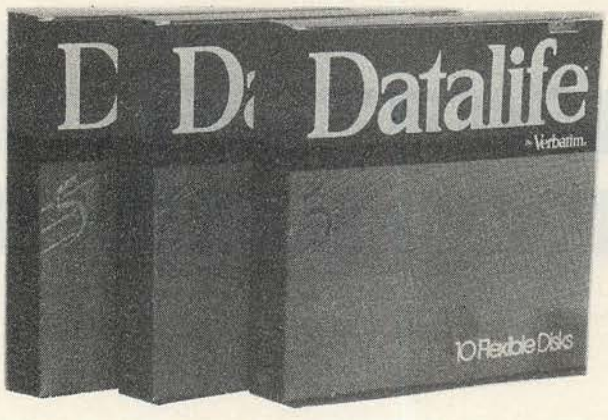

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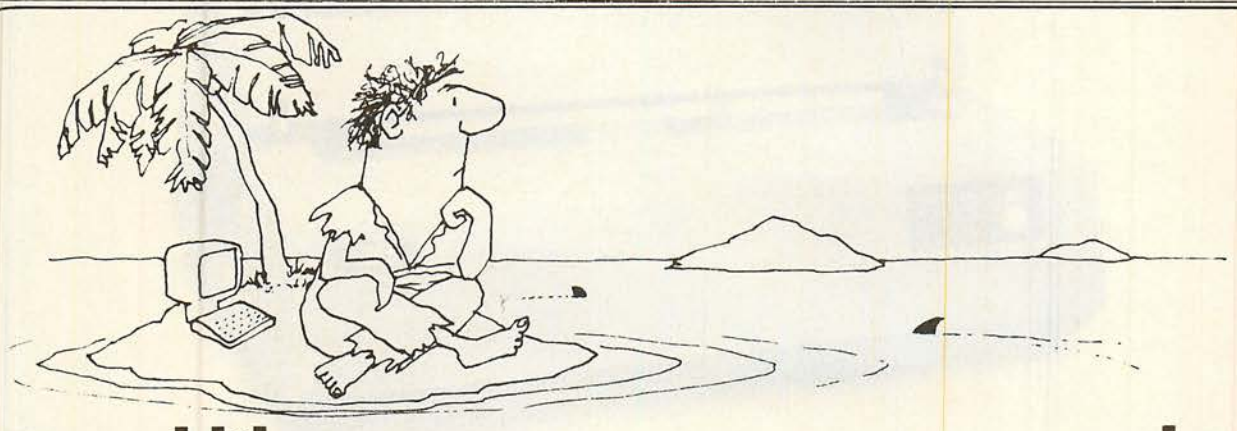

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WP – a way with words

Glyn Moody considers the current state of the word-processing art and examines some packages for the office, school and home, while Jack Schofield gives Bank Street Writer a thorough going over on the Atari.

IF A MAN or woman on the Clapham omnibus were asked to name some serious uses of computers, he or she would almost certainly name word processing, along with spreadsheets and possibly databases. For many businesses, the first taste of micros is through a word processor. From the managing director impatiently awaiting the seventh revised draft of a memo, to the copy-typist who is producing the same final-demand letter day in, day out, everyone is able to appreciate the need for a machine storing a document and allowing it to be altered before printing.

It is no accident that we speak both of microprocessing and word processing. The main chip is a device for manipulating strings of bits. As soon as a letter is translated into binary — usually via the standard ASCII codes — letters and words become just another set of data that can be acted upon. Unlike the up-and-coming expert systems which require a conceptual leap in terms of analysis and implementation, word processing is already an established application.

Golden Age

We are entering the Golden Age of word processing: packages have been around long enough for basic characteristics and needs to have been established. As the user base continues to expand enormously so the competition among software houses increases, and with it, so the theory goes, the choice. This process will not go on indefinitely. Already the first faltering steps have been taken towards voice-recognition systems. When this technology is perfected the emphasis will shift to the intelligent dictating machine, rather than to the intelligent typewriter which is what word processors represent now. But the time-scale of, say, five to 10 years, is sufficiently long that the basics of word processing as we know it will be with us, if increasingly refined, for a good few years to come.

Although there were a number of precursors such as Scripsit, it was the word-processing package WordStar from Micropro that really defined standard word-processing functions and, unfortunately, bedevils later packages through their aping of some of its less happy features.

This introduction to word processing begins by considering what solutions WordStar offered to what problems, and comparing this with two more recent products, Edword and Homeword. Unlike WordStar, which is geared largely to the business market and runs on CP/M machines, Edword is designed for schools and runs on the BBC Micro. Homeword, as its name suggests, is primarily for home use on the Apple, and is interesting for its use of the latest icon techniques.

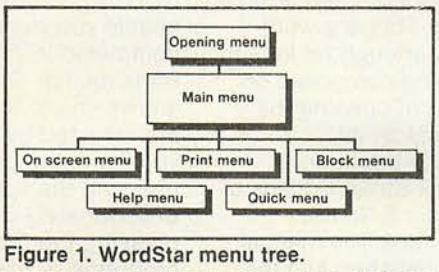

Figure 1. WordStar menu tree.

Although WordStar is generally accepted to be a very powerful and versatile word-processing system it is not user-friendly. This is despite the fact that its command structure uses a simple tree of menus — as shown in figure 1. When you boot WordStar the opening menu presents functions dealing with file management. After pressing D to open a file document, and giving it a name, the main menu is obtained. The format repeats that of the opening menu Groups of commands called up by simple keystrokes, but already the dreaded control character, represented on menus by ^, has reared its ugly head.

Thus simple cursor movements are effected by pressing Control and one of a cluster of keys to the left of the keyboard: ^S for character left, ^D right, etc. One problem is that next to ^F, which allows you to move to the word on the right, is ^G, which deletes the current character. At each level of the menu the keyboard bristles with redefined meanings so that missing a

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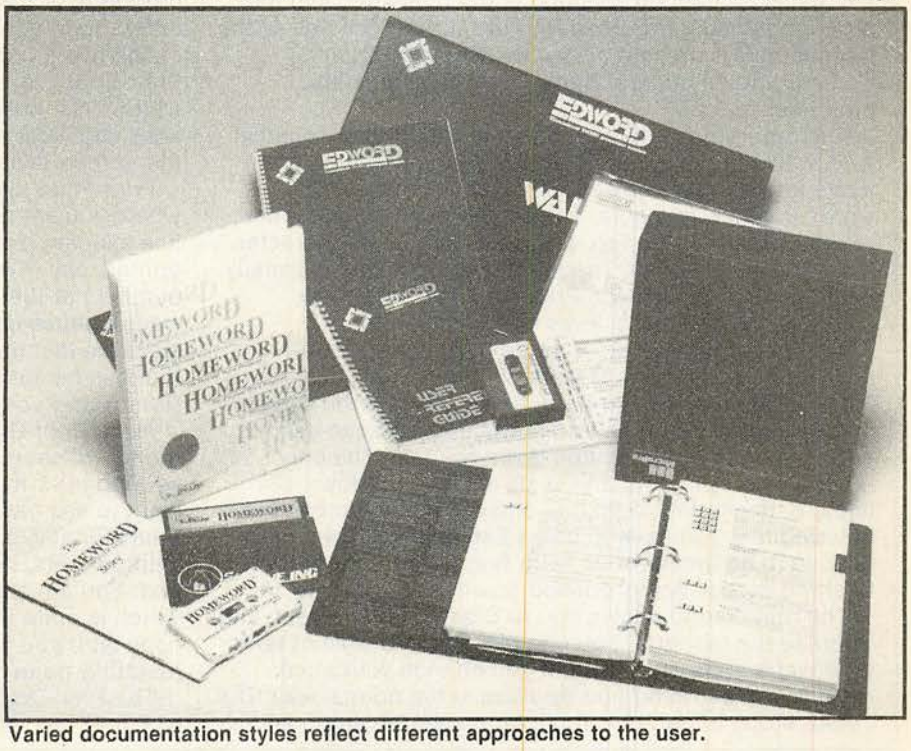


Varied documentation styles reflect different approaches to the user.

(continued from previous page)

key only slightly can cause drastic changes.

Other possibilities on this menu are moving to tab stops and inserting a Return. In WordStar, and in most subsequent word-processing software, Return inserts a hard — that is compulsory — Carriage Return. Other soft Returns arise naturally out of the wordwrap facility. Pressing ^B allows text to be rearranged within change margins.

The remaining commands take us down to the next level of menus. Pressing ^J introduces a sequence of useful Help screens. Again the format remains the same: single keystrokes select particular options. Pressing ^D produces the on-screen menu which lists commands for formatting the screen. In addition to standard options like Left and Right Margin, Paragraph Tabs and Normal Tabs, there is a centring facility and line-spacing command.

WordStar also has various toggles — switches that can be On of Off — which represent particular options for screen format. For instance, when wordwrap is On, entered text that spills past the right-hand margin is automatically taken over on to the next line: no tedious manual Carriage-Returns are needed, and your concentration on the input copy is unbroken. In this mode, a whole word is taken, but a further possibility is to introduce soft hyphens. A soft hyphen gives WordStar the option of breaking a word at the soft-hyphen point. This is useful if a long word appears frequently in a text. Without soft hyphenation, such words will always be taken over in their entirity, leaving unsightly emptiness in the line behind. If the Justify toggle is On, then spacing is introduced to even the lines out.

The block menu is called up by ^K; from here, files can be saved, abandoned and exited from. As its name suggests, this menu is also concerned with block operations. One important feature of copy on paper is being able to physically manipulate it by cutting it up and pasting it down in a different way. The possibility of moving chunks of text in a clean and effortless way is a prime advantage of electronic word manipulation. It is also an area where the differences in approach between various word-processing packages emerge.

Block pointers

WordStar defines the blocks by means of delimiters placed in the text. Naturally these markers are invisible in the final print; they are normally deleted after a saving to file. The characters <B> and <K> mark the beginning and end of a block; this block can then be moved or copied elsewhere using the V and C commands. Block text is transferred to the current cursor position. Blocks can also be deleted and read, or written from one file to another.

(continued on page 54)

Bank Street Writer

Broderbund Software is best known for its collection of arcade games for the Apple and Atari micros, including several smash hits — Choplifter, AE and the original Apple Panic. Last year Broderbund entered a new area of publishing with the Bank Street Writer. This is a word processor that is supposed to be easy enough for kids to use. It could well be. This review is being composed on the review program within half an hour of opening the box and there are no obvious problems at all.

The Bank Street Writer was written by Intentional Educations Inc. together with The Bank Street College of Education, New York State, and Franklin E Smith, software design and marketing consultant. The manual credits 15 names. Broderbund is the publisher, and the program is being imported into the U.K. by Softsel. At the moment it is on disc only, for the Apple, Atari and Commodore 64 micros. Bank Street Speller is also promised.

The program is supplied on an autoboot disc together with a 32-page manual. After powering on, the program loads into its text-entry screen, with room for 2,333 words in a 48K machine. The screen provides four lines of information at the top, and an 18-line by 38-character box for you to type in. The main command line is usually headed Write Or Correct. Pressing the Escape key changes the command lines to the main menu.

The main menu offers a range of options, namely Erase, Unerase, Move, Moveback, Find, Replace and Transfer Menu. The text-entry block remains the same, except you cannot type into it. Instead, you can use the cursor keys to scroll up and down the text. The only other text movements are: U, up 12 lines; D, down 12 lines; B, beginning of text; E, end of text. To go back to entering text you have to press Esc again. All text entry is done in an Insert mode, with text to the right of the flashing cursor being pushed down the screen to fit.

The main menu allows you to Erase blocks of text, and Unerase the last one. You can also Move blocks of text, or Moveback the last block if you change your mind. Finally, you can Find and Replace in the normal way. The cursor stops at each example of the search string and invites you to change it or not by answering a yes or no, Y/N question.

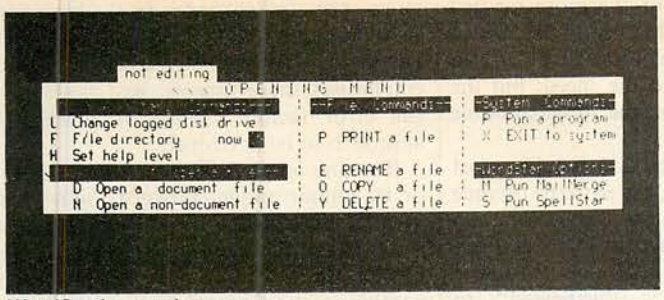
Selecting the Transfer Menu option brings up another two rows of commands offering nine new options which enable you to do things with the text once you have completed it. The options are Retrieve, Save, Delete, Rename, Init, Print-Draft, Print-Final, Clear and Quit. Init allows you to format a new disc. In each menu, options are selected by positioning the cursor over the option you want and pressing Return. The cursor is moved by pressing the space bar and the < and > keys. Unfortunately it is not possible to select an option by pressing the first letter of its name, as it is in many programs — for example, Multiplan. To return to the text-entry mode you press Esc once or twice.

The two printing options are Print-Draft and Print-Final. Print-Draft prints text double-spaced by 38-characters width. This makes it easy to proof-read and to find the lines you want to correct, since the hard copy matches the screen layout.

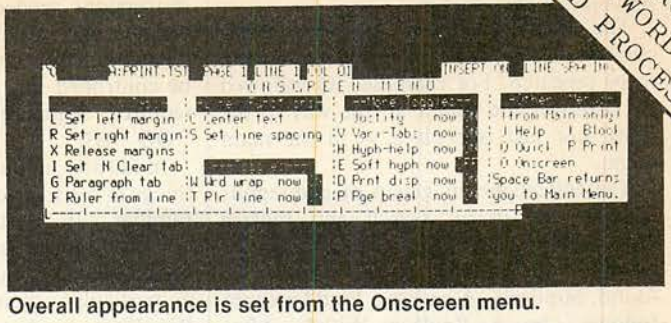
Print-Final takes you through a stream of options where you set the number of characters per line, set the line spacing, say if the file is chained to the last file printed, say if you want page numbering, put page numbers at the top or bottom of the page, say if you want a pause between pages, and finally, if you want to eject the last page. All of these options have defaults that can be set, so usually it is just a matter of pressing Return and scooting through them.

Next, Print-Draft invites you to type in a heading for the top of each page other than the first, and asks if you want to print the whole text. The prompt then asks if you want to see page breaks, and if so, allows you to adjust them. Finally, it asks if the printer is ready. All this, even with defaults, requires 15 Return-keys to print a two-page text. You are asked if you want to print another copy which is quite simple, but if you want to print another copy later you have to go through the whole process of resetting page-breaks and so on all over again.

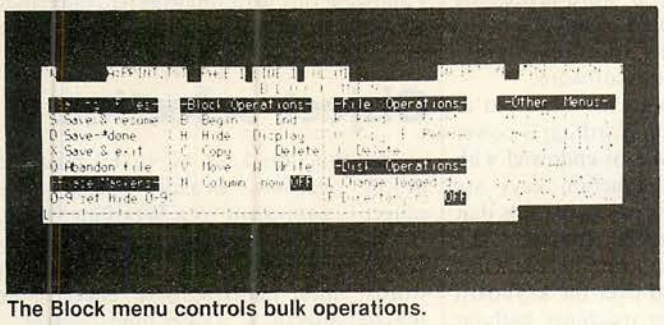
The Print-Draft program uses a similar set of options to Print-Final, but in this case they are built into the



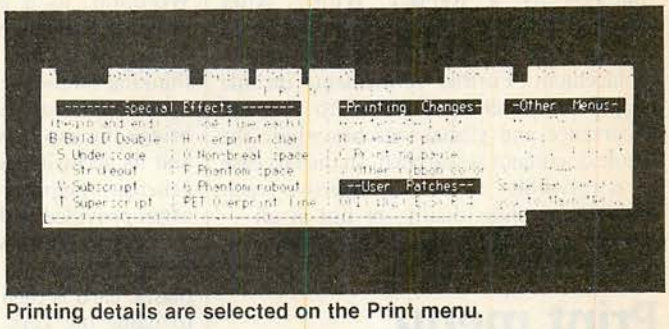
WordStar's opening menu.



Overall appearance is set from the Onscreen menu.



The Block menu controls bulk operations.



Printing details are selected on the Print menu.

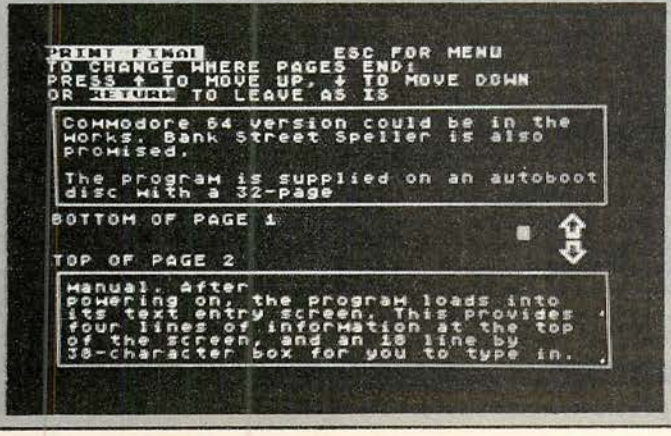
program. To change them you have to Quit and load a utility program on the disc. This allows you to set the left margin of the Print-Final routine, which is not adjustable from the main program. The default value is eight characters.

Using this program you can change: the number of the default disc drive from 1 to 4, the top and bottom margins, whether page numbers are at the top or bottom of the page, whether there is a line feed on Carriage Return, and the form-feed character of your printer. The last two options are very useful, and can save uncasing the Epson to get at the DIP switches, or jerking through almost blank pages line by line.

When saving files to disc you can type in a three-letter code as password protection and the utility program allows you to read any long-forgotten passwords. Finally, you can also set the Atari's keyboard clicker On or Off; the default is Off.

The utility program does not offer a choice of colours for the text, background and borders. With 256 to choose from on the Atari, that is a sad omission. Bank Street Writer offers you the standard white letters on a mid-blue background. This is more legible than the Commodore 64 standard, but not as good as the deeper blue of Atariwriter.

The Bank Street Writer is certainly easy to use. The user interface is consistent, and the program sturdy and reliable. It is nice to get two copies of the program disc. The word processor itself also has one or two felicities. I particularly like the way it checks page endings by



showing you a screen with two boxes: the bottom of one page and the top of the next. You can use the cursor keys to move the page ending up or down. Another good point is the Tutorial program which is supplied on the reverse of the program disc. It is very short but provides a quick way into using the program's facilities. The error messages and information from the program are excellent. It reminds you, for example, if you try to Clear a text you have not Saved — enabling you to undo deletions you instantly regret.

There are some infelicities. The Indent facility, set by Control-I, indents not just the line but the whole text up to the next Return. The facility is there because otherwise you have to exit and load the utility program to change the left margin.

In text-entry mode, there is an unpleasant hiatus when you reach the bottom of the text-entry box, while the program moves the last line of text half-way up the screen. It is possible to lose a character if typing quickly here. Again, it is not as good as having a continuous scroll, as on Atariwriter.

Although you can centre text by using Control-C, and find how much space remains by Control-S, there seem to be no other features. No bold, no italics or other type styles. No underline. No subscripts or superscripts. No justification. There must be a way of sending control codes to the printer, but if so I cannot find it in the handbook.

I found a personal annoyance in Bank Street Writer's choice of B for beginning and E for end especially since Atariwriter uses T for top and B for bottom. Also, Bank Street Writer regards all Atariwriter files as protected, so you cannot use it to edit them.

Bank Street Writer achieves its aim in being extremely easy to use, which should give it a ready market among Apple II owners with children. It is not easier to use than Atariwriter, is less powerful than Atariwriter, and Atariwriter has two added advantages: it is on a ROM cartridge instead of a disc, and it works with the XL range of micros. Under the circumstances the program cannot be recommended to Atari owners.

Bank Street Writer is distributed in the U.K. by Softsel of Softsel House, Central Way, Feltham, Middlesex. Suggested retail prices are £56.30 for the Apple and Commodore 64, and £57.90 for the Atari. The Bank Street Speller will cost about the same.

(continued from page 52)

The menu ^Q allows a number of basic cursor movements found in the main menu to be repeated. For example ^Q followed by D moves the cursor all the way to the right, not just one place as in the main menu.

The Miscellaneous group of commands includes the useful search and replace procedures. Pressing F after ^Q brings the prompt Find? asking for the word to be found. Similarly, A causes a Find? prompt followed by a Replace With?. After locating the first occurrence of the word to be found, a Y/N prompt allows replacement. Further refinements include backward searches, searches to the nth occurrence and global searches where the whole document is searched. In the last case it is possible either to approve each replacement individually, or not at all — but this is only recommended for those with great self-confidence.

Print menu

The final menu ^P deals with the print options. WordStar allows a full range of print effects, but at a cost. The menu presents the relevant command keystrokes: B for bold, T for superscript etc. When a command is entered, the screen shows each character preceded by the familiar ^. As with a block marker, this is invisible when printed, but changes the mode in the required way. Using strings of these characters before and after the relevant text allows you to set up elaborate print variations. But the resulting screen layout is ungainly and unclear. The ultimate solution is WYSIWYG — what you see is what you get — where the screen reproduces the final form of the document exactly. Recent word-processing packages are moving in this direction, though a full implementation is still awaited.

Facilities such as justification, word-wrap, block moves plus search and replace form the heart of WordStar and represent the core elements of any word-processing package. Most situations encountered in the office and at home can be handled using just this set of operations. But WordStar goes much further and offers a range of commands enabling detailed page layout.

For example a set of dot commands — entered by prefacing a two-letter command by a full stop — allows a specification of page breaks, and standard headings and footings. Assuming the printer can keep up with WordStar's prodigal command sequences, you can arrange for bi-directional printing, character pitch and line-height changes, plus switches between ribbon colours. Dot commands add a further level of complexity to WordStar by complementing and extending the control-key commands. Unfortunately, they also destroy what overall rationale was ever evident.

It is probably true to say that few people use the WordStar system to the full. But this is partly a result of the opaque series of instructions needed for the more rarified options. For example, using the Quick menu, the reformatting procedure can even be controlled down to the speed; but the required sequence is the unmemorable ^QQ ^B3.

In fairness, it must be said that, like most things in constant use, the patterns become familiar. In a business situation, an operator can be trained to learn and use these sequences. But this is only feasible if a particular typist is "dedicated" to WordStar; as a general word-processing program that can be used by anyone in the office, WordStar falls short of current thinking on user-friendly software.

A number of solutions have evolved to bridge the gap between WordStar's power and its accessibility. Micros endowed with generous helpings of function keys are often provided with overlay programs that set keys to entire WordStar functions like Block Move etc. An appropriately labelled plastic card is then laid over the keyboard to name the keys. For machines without such luxuries, add-ons such as the Keystar box allow WordStar to be run by single keystrokes. In this case, the separate dedicated unit plugs into an RS-232C port.

A recent product from Clwyd Technics Ltd called Edword draws on many of WordStar's features and adapts them for the educational context. It comes as a ROM chip that plugs in alongside the chips for BBC Basic and the operating system, which must be version 1.2 or later.

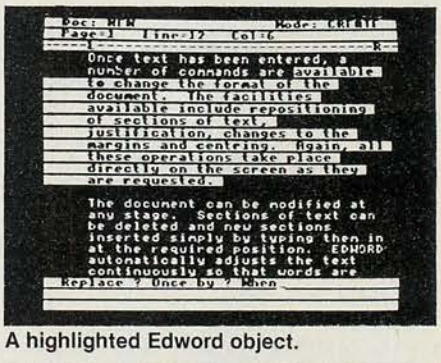
Word processing can fulfil a real need in schools. Typing is widely taught and typing courses aim to teach two things: keyboard familiarity and technique, and the ability to produce perfect output. Pupils frequently become frustrated and alienated from keyboard work by the constant retyping required for perfect output. Word processing changes that by eliminating the need for perfect first-time entries. The stress can be shifted on to keyboard familiarity and more creative aspects of keyboard input such as layout. Edword emphasises these aspects, and through a full error facility enables an interactive approach to be developed.

Running on the BBC Micro in either 40- or 80-column mode, Edword follows the WordStar tradition while making what use it can of the available function keys. Thus F9 becomes the Command key, comparable to the Control key in WordStar. Following this with single-letter commands allows operations like centring, block movements and print modes.

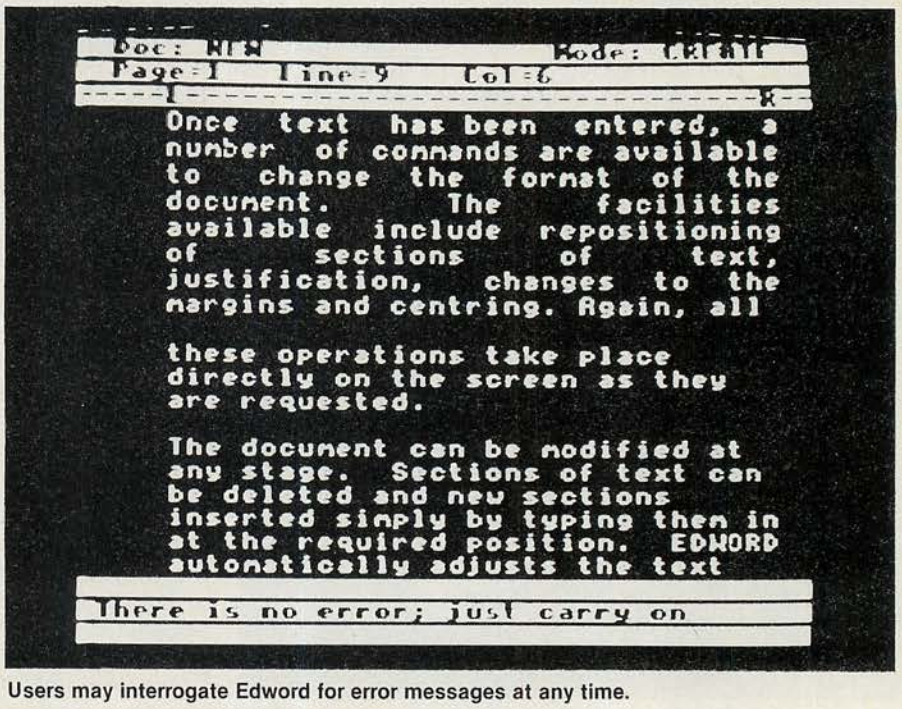
Object selection

The function keys F0 to F3 relate to object selection. Broadly speaking an object is equivalent to a WordStar block. But instead of defining blocks by semi-visible end markers, Edword permits words, lines, paragraphs or pages to be selected directly — a clear improvement.

Pressing F5 justifies the current object. Unfortunately one weakness of Edword is that it is not possible to unjustify text: inserted spaces must be removed by hand. Pressing F6 underscores an object, while F7 is a straight Delete option. If a particular object is selected, all of it will disappear; if



A highlighted Edword object.



Users may interrogate Edword for error messages at any time.

not, only the character at the current cursor position vanishes. Pressing F8 calls up the print facilities, though only very limited type formats are available.

Other standard features such as searches and global replacements are offered, along with page formatting. A separate format table can be called up to allow margins and tab positions to be set.

Clearly Edword is very much in the WordStar mould, although it has moved away from the nested menu structure and only F9 has a large range of command options. A shift of emphasis is apparent in the manuals. The WordStar manual consists of a ring binder with full cross-referencing, menu tables, diagrams and line drawings featuring real-life WordStar situations. In contrast Edword has put together a veritable action pack for teachers and pupils.

Apart from a spiral-bound student's guide, there is a reference manual, teacher's guide, overhead-projector slides and wall-charts. The package appears well thought-out in terms of its operation in a school. However, like WordStar, Edword usually requires a conscious effort on the part of the user to translate the desired effect into a keyboard command. The manuals present the various options but with little explanatory background, and jargon is used from the start. More could have been made of the opportunity to introduce pupils to a real-life application of the micro.

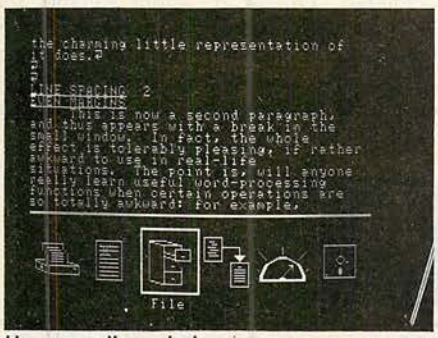
It is doubly apt that the word-processing package Homeword from Sierra On-Line Inc., should be written for the Apple II. First, this is software written specifically for home use — and what better machine than the one that started the home micro boom. Secondly, it uses the latest techniques of Apple's icons.

When you boot up from the Homeword disc the main menu of icons is displayed. They occupy the lower third of the screen, and particular functions are chosen by moving the icon cursor — a rectangular frame — using the cursor keys. The highlighted option is also named in the centre of the icon, which is often necessary since the imagination is sometimes stretched when trying to recognise Homeword's logo for making back-up documents for example.

The main menu offers print, edit, file, layout, customise and disc options. The chosen item is entered by hitting Return. This leads to a further menu of related choices. For example the Edit icon leads to a choice of moving, copying, finding and replacing text. The icon menus are nested to a maximum depth of three levels. As in Edword, the Esc key is used to move out of menus of commands to the next level. Hitting Esc at the level of the main menu converts the upper two-thirds of the screen into the typing area. The lower third now displays information on the RAM available and disc usage, as well as a miniature representation of the input area, complete with a tiny flashing cursor. Since the main display area can only accommodate about a third of a standard page in single spacing, this is a valuable facility. Double and triple spacing as well as margins are shown in proportion. Esc is also used to return to the main icon menu.

The icon structure allows nearly all file operations, from disc management to print style, to be set up by simple on-screen selections. The icons themselves are clear and generally sensible choices.

The bad news is that on-screen manipulation is palaeolithic. Once again the procedure of pressing Control followed by another key is used to move the cursor, toggle Insert mode and delete characters. Worse news is that the control codes are mostly different from those of WordStar.



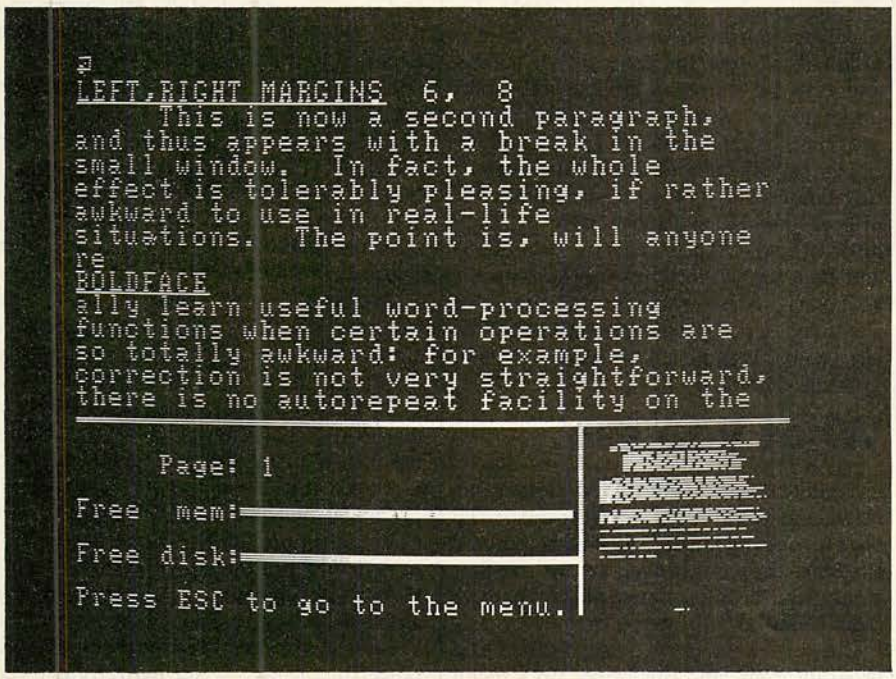
Homeword's main icon menu.

Prices and suppliers

WordStar: Runs under CP/M, MS-DOS. Cost £295 plus VAT. Details from Micropro. Telephone: 01-879 1122.

Edword: Runs on BBC Model B with operating system 1.2 or later. Cost £56.95 plus VAT for starter pack including printer configuration cassette. The cost for the non-educational package, without the teacher's guide and wall-charts, is £48.95 plus VAT. Details from Clwyd Technics Ltd. Telephone: 035 283 766.

Homeword: Runs on Apple II, II Plus and IIe. Cost £33.95 plus VAT from Pete and Pam Computers Ltd. Telephone: (0706) 212321. Also on Atari and the Commodore 64, both at £35.95 plus VAT. Details from Softsel. Telephone: 01-844 2040. A version of Homeword also runs on the PCjr — see the February issue of *Practical Computing*.



The full page format is shown in miniature as text is entered.

The way ahead

Homeword, occupies an intermediate position in the evolution of the perfect word-processing package. Its use of icon menus is well conceived and implemented, and represents the way forward. The Apple II is partly to blame for the archaic cursor controls and as with WordStar, frequent use will go some way to alleviating this problem. The package is cheap at only £33.95 from Pete and Pam Computers, though the manuals are indifferent.

WordStar, Edword and Homeword represent successful responses to the particular needs of the business, school and home. Whatever its faults, WordStar will always be standard against which later word-processing packages will be measured — in particular to what extent they offer user-friendly prompts.

New word-processing systems will therefore probably develop in two directions: first, in the use of icon methods to allow ready access to a full range of WordStar type facilities, and secondly in the provision of a total environment for the manipulation of data, be it text, numeric or graphic. By the time these information processors are available, voice recognition will probably be viable. Marrying these two should produce some interesting results.

The one for WP

Jack Schofield assesses what it is about the IBM PC that has made it the foremost word-processing micro.

IN THE two-and-a-half years since its launch the IBM PC has become the main word-processing micro, and thus the most popular machine for word-processing packages. There are currently over 40 available in the U.K., without counting multiple-purpose offerings such as Silicon Office. In the U.S. — excluding all the British programs — my last count was 103. That means a new WP package has come out for roughly every week of the machine's lifetime.

More interesting than the volume is the quality of many of these programs. Microsoft's Word, for example, reviewed in our December 1983 issue, sets a new standard in ease of use, while Visi On Word from Visicorp also promises a Lisa-like environment with multiple windows.

In addition, virtually all the best established packages have been transferred to, and improved for, the IBM PC. Examples include Final Word and Mince, both from Mark of the Unicorn, and Perfect Writer, which we reviewed in February 1983. There are all the old favourites like WordStar, Spellbinder. Benchmark, Easywriter and Peachtext, which used to be Magic Wand.

If you like the Wang style of dedicated word processor, you can have Multimate, from Softword Systems, reviewed on page 60 of this issue. In any case, the IBM PC is exceptionally good as a word processor. The screen display given by the monochrome monitor is very clear and easy to read. In addition the keyboard, notwithstanding some regrettable key placing, is superb for touch-typing.

This concentration on catering for the IBM PC need not be greatly to the detriment of other brands of micro. There is already a large market for IBMulators like the Columbia PC, supplied in the U.K. by Icarus, and PC-compatible transportables like the Compaq, Corona and Dynalogic Hyperion. In the future, with the launch of the Advance — see our October 1983 issue — and the PCjr the benefits will begin to be seen even at the cheaper end of the market. Also, successful packages that were designed originally for the PC will surely be transferred to other popular micros. With these thoughts in mind, *Practical Computing* has selected three WP packages on the IBM PC for this special report.

There is one limitation which must be borne in mind: customising the keyboard. Many popular word-processing packages supply sticky labels or even customised keycaps so that the function-key assignments and so on can be easily identified. This makes the programs much easier to learn and use. When using several packages on the same machine, and switching between them at frequent intervals, it is impossible to use this facility.

Finally, remember that there is no single best word processor. Some are more suitable for long texts where perhaps formatting is not important and maths not required. Others are more suitable for shorter texts where the precise layout is most important. There are numerous other possibilities too. With so many packages available for the IBM PC, there must be something for everyone.

TRENDTEXT

An easy-to-use package converted for the IBM PC.

THE INTRODUCTION to our IBM word-processing reviews was composed using Trendtext, and comprised 618 words — or at least it did before it reached the subs' desk. Trendtext is a powerful package. It is easy to use, and has many extra facilities such as maths, graphics capabilities, mail-merging, contents and indexing, plus limited data-handling facilities and word counting. It also has a few idiosyncracies on the IBM PC, probably because it was not originally written for this machine.

Trendtext is supplied by Microtrend U.K. ' Pately Bridge, North Yorkshire. Thou he company is a branch of the Dutc m Microtrend International bv, the p. ıge was in fact written in the U.K. and is well supported here. However, the international nature of Microtrend's business means that great attention has been paid to coping with the IBM character set. The package provides for multi-lingual word processing, and claims to print all the characters that the IBM PC can generate. The ability to print Greek letters and mathematical symbols as well as simple graphics makes Trendtext suitable for scientific word processing too. It was originally written for the eight-bit market and runs on most CP/M machines. The package reviewed here should, strictly speaking, be referred to as Trendtext-2.

The package comes in an A4-size four-ring binder with 11 chapters of computer-printed manual in letter-quality printing, not dot-matrix. There is also a sheet of red and blue sticky labels for customising the keyboard. All the labels are used for Trendtext-2, and subsets are marked off for use with Trendtext-1, Lexicom-1 and Lexicom-2.

What you see...

Trendtext is a menu-driven, document-orientated WYSIWYG word processor. To boot it you type Menu, followed by Return. Pressing any key then brings up the first menu, which offers a range of eight choices from 0 Exit to 7 Printer Selection.

Pressing 2 loads the word-processing program itself, and this brings up a menu offering nine choices from 0 Exit to 8 Merge Files. You press 2 again to edit a file, and then you are asked the drive name and file name. If the file name exists, Trendtext fetches it and puts it on the screen.

If the file name is not found the program asks for confirmation that this is a new file — after all, you may have the wrong disc in the drive. If the answer is Y, Trendtext creates it by writing the name to disc. You are then presented with the main text-entry screen, which looks like the one shown in figure 1.

The screen is commendably clear, and tells you the name of the document, the cursor mode, the current line number and the mode. In figure 1, the file called TText is on the hard disc drive C, the cursor is moving a character at a time, the line number is 1 and the program is in Insert mode for text entry.

Cursor movements can be made not only by character and by line, but also by word, by sentence and by paragraph. The facility to jump through text a sentence at a time is a delight. As well as moving by these units, Trendtext will also Delete by them. This is a powerful facility — but dangerous if you are in the wrong one. Trendtext uses the

Insert key for toggling in and out of the Insert mode; when you are out of it you select the type of cursor movement required by pressing the Return key.

Margins and decimal tabs can be set on the rule across the top after pressing the F2 key. While the screen can only show up to 80 characters across, Trendtext can scroll horizontally to a maximum of 255. It does so by jumping forward to a new screen each time you push beyond the limit of the old one.

Trendtext uses control characters, entered using the Control key and the IBM PC's 10 dedicated function and other special keys. The Control key is mainly to embed formatting controls for the printer, and there are 15 options in the range.

The printer Control options are easy to remember because most use the first letter of what you want to do. For example, Ctrl-B is used for Bold printing and Ctrl-C for centring text. Options include headers and footers, subscripts and superscripts, overstrike and underline. Choose Crtl-X if you want to index something, or Ctrl-Z for merging text from another file. Ctrl-S stops the printer, in case you want to change a daisywheel in mid-page.

All the formatting commands produce an invisible character on the screen, and the function key F6 toggles them between Hide and Reveal. On Reveal they appear as inverse caps of the character, so you can check that the format controls are really there, but on Hide your text is clean and easy to read. It is an invaluable feature.

Conversion

One catch is that you enter Ctrl-H for a header, but to do so on the IBM you have to press Ctrl-A. The Ctrl-H symbol then appears on the screen. Ctrl-H, as so often in the word according to Microsoft, is a destructive backspace. The Range Right character is an inverse >, but to enter it you have to press Ctrl-R; meanwhile the inverse R on the screen is produced by pressing Return. These things happen all too often with conversions, and to pick them up you have to read very closely the IBM-specific details added to the standard manual.

Trendtext also offers a useful soft hyphen, Ctrl-G. If you set a 45-character margin then as you type in the text, it is displayed on 45-character lines, as shown in figure 1. It is tempting to put in hyphens to even out the lines; but suppose you insert a few corrections, or change your mind when printing out the text? Change the width to 50 characters, and Trendtext will happily reformat it while printing with those hard hyphens still in place. If you use soft hyphens, Trendtext joins the split words back together again if they fit on the same line.

The IBM function keys are used for large-scale editing functions such as large cursor movements or block moves, which are done quickly with F7 and F8. For example, F1 is used to Exit from editing a document, and F3 for Search and Replace.

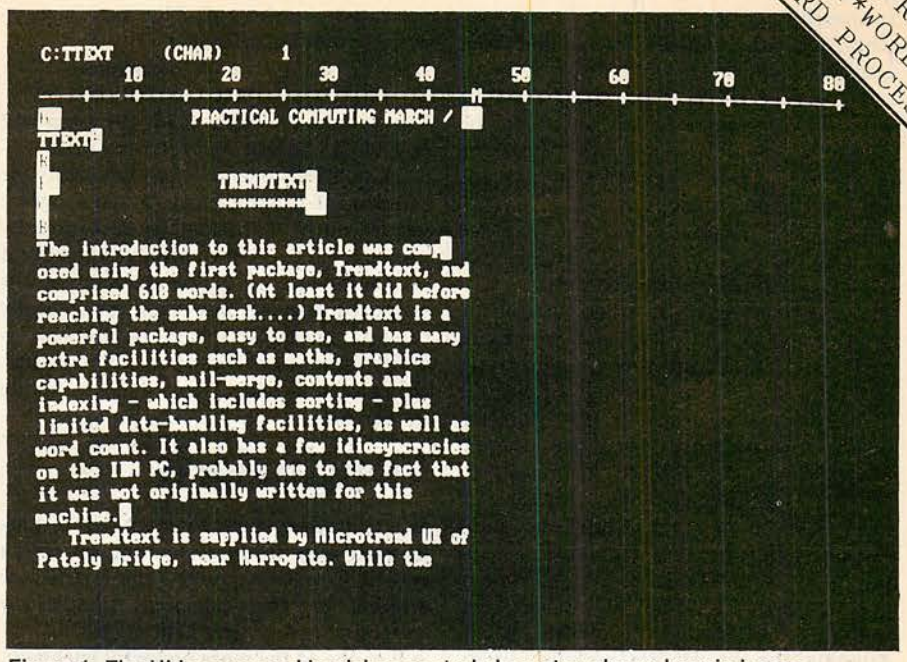


Figure 1. The Hide command banishes control character, shown here in inverse.

The bottom six function keys, numbered from 5 to 10, are also used with the Alt key for the screen calculator. For example, Alt-5 is used to add, Alt-6 to subtract, Alt-7 to multiply and Alt-8 to divide, these being the limit of Trendtext's computational ability.

Most other IBM PC special keys have been implemented correctly, so pressing PgDn moves you one page down the text. Oddly, however, the PgUp key takes you back to the very beginning of the text. If you really want to go up a page you have to press the Home key twice.

Trendtext is versatile and powerful, and seems to be able to handle virtually any sort of text. However, it does have a couple of limitations, and a few problems were encountered during the review. One of them is that you cannot change the margins or the line spacing while you are printing out text. This makes it complicated to produce texts with, say, extensive quotations, where the quotes are printed narrower and closer together than the main text.

Chained files

What you end up doing is Chaining files together. If you use the Chain facility, you simply write another file which contains only the file names of the documents you want to print, in the order you want them printed. Then you print the document as a succession of small files. It is a messy procedure compared with the ease of being able to embed line spacing and margin instructions directly in the text.

During this review my feelings for Trendtext went through three distinct stages. To begin with I liked it because it is very easy to use even if you have never used it before. While it has some more powerful features than WordStar, they are completely invisible to the user who does not require them; the package never looks complicated. When you do need to learn a new technique, it can generally be found via the index at the back of the manual.

During stage two I began to dislike Trendtext a lot because the menus and defaults prevented me from using the package the way I wanted to. For example, before every printing session I would have to go through the default settings and change the number of lines, width, single to double spacing and so on. Then when I tried to install it on the XT hard disc drive C the user-friendly floppy version refused to accept any drive identifier except A and B.

Support

To silence my barrage of complaints and initiate stage three, a support-person came round from Microtrend. He revealed the secret control that provides access to the innards, so I was immediately able to make C: permissible, customise the defaults, and even write my own printer drivers using the simple utilities included. Within an afternoon I was back in love with the package, and have often used it since.

There are still some things I dislike about Trendtext. One of them is that it is all too willing to discard text from memory, which makes me nervous. For example, if you want to print a text, you save it and go to the Print menu, but this involves reloading the file you have just dumped. Similarly if, after printing, you decide to print another copy, this again is reloaded from disc.

This disconcerting habit arises because Trendtext is designed to cope with very long texts. When you have filled RAM it writes text to disc and carries on. Thus at the end of the text it goes back to where it definitely knows it can find the beginning — which is not in RAM but on the disc file it started before allowing you to start entering text. This is very good for people who write long texts or who only have 64K machines, but

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with 256K in an IBM PC and chained files available it is not a vital feature.

My second dislike is an extension of the first — there is no deep way to subvert the menu system. However, it must be admitted that using the menus provided is not particularly arduous.

My third dislike is that the package utilises some of the PC-DOS error trapping, instead of being completely self-contained. If you try to print without the printer on, you get Microsoft's wonderful message asking if you want to abort, retry or ignore the failure. Pressing A for abort would then leave you in the operating system with no word-processing program and not text.

When this happens with a Disc Full message the error can be a fatal one, and I lost one article because Trendtext told me my floppy was full. It wasn't, of course, but somehow Trendtext and I had been opening files and not closing them. Running the PC-DOS Checkdisc utility produced another of Microsoft's wonderfully obscure epigrams,

14 lost clusters found in 14 chains
Convert lost chains to files (Y/N)?

The affirmative reply made an extra 412 free blocks appear, but no extra files.

This curious phenomenon highlights the problem of using a menu-driven program where you perform complex tasks just by hitting a function key, without knowing if everything really is happening the way it is supposed to. At any rate, periodically running Checkdisc solved the problem — which may have been of my creation. Microtrend now has a new challenge: trying to recreate it.

Conclusions

● Trendtext is easy to learn. It is particularly easy to do formatting on screen and, if necessary, preview the text before printing it. This makes it suitable for secretarial and general office work.

● It is one of the more powerful packages, although it presents a simple face to the user. The facilities to print Greek and other foreign characters, print graphics, handle decimal tabs, do calculations and indexes make it suitable for scientific and technical use. It can handle long texts in pages too.

● The inclusion of extra features like mail-merging, limited data handling, word count and the production of indexes makes the package better value than it looks at first sight. However, it does lack a spelling checker.

● It was my experience that the package is well supported on the telephone, even when the people at Microtrend don't know they are talking to a computer magazine.

● The IBM PC implementation represents a compromise. Though the package does use the special facilities of the machine, it is probably just as good on other CP/M and MS-DOS micros.

● Trendtext costs £350 plus VAT from Microtrend U.K., Council Chambers, School Lane, Pately Bridge, Harrogate, North Yorkshire.

WORDPLUS-PC

A package written specially for the IBM PC, tested by Paul Myerscough.

WORDPLUS PC comes in an attractive 2lb. package which includes a manual matching IBM's own format. The program is on a single floppy disc, and there are some stick-on function-key labels and a quick reference card.

The documentation is designed for non-technical users. Without opening the *Guide to Operations* or the DOS manual supplied with the IBM PC you can learn all that is needed about formatting discs, making back-up copies, use of the keyboard and so on, and begin typing productively. A good, well paced tutorial introduction fills the first 234 pages and refers to several text files provided on the disc. The reference section, which follows, is organised into six different function-areas and covers about 100 pages. There are appendices on DOS, error messages, printer trouble shooting, command formats and an index.

Before you start to use it,Wordplus-PC must be configured to the printer in use. About 30 options are available on the set-up menu. It appears that the package was developed primarily for the NEC 3550 Spinwriter. Other printers may not be able to support all the features offered by the word processor, and it is possible that even a printer which appears on the option menu may not make a perfect match with the software. You should test your printer with all the text-formatting operations that are important to you, rather than make assumptions about compatibility. Of course, the same goes for all word-processing software.

You are very soon reminded that this software was produced with the PC in mind: the Caps Lock and Num Lock keys are both signalled on the screen. The Pg Up and Pg Dn keys are implemented and cause continuous, rapid scrolling which may be halted by hitting any key. The End key causes similar scrolling, while Home gives immediate access to the start of the text.

Text files are held in memory while being edited, which limits their size to about 200 lines. This causes few problems, however, as files can be linked for printing purposes by an embedded command. The text window — see figure 1 — uses the first 22 lines of the screen. The last three lines are reserved for system information and messages which give the current cursor position, current options in effect and selection prompts.

Command	Function	Comments
bm	set bottom margin	0-255
ce	centre text	On/Off
cl	comment line	not printed
clp	comment with printer pause	displayed during printing
fo	define page footings	up to three lines
fp(n)	force page	if current page has <n lines remaining
fa	form advance	six or eight lines per inch
he	define page headers	up to three lines
hi	horizontal spacing	from 1/120in. to 14/120in.
ju	justification	
lm	set left margin	1-255
la	line advance	up to one full page
sp	line spacing	1,2, or 3
mr	margin release	−255 to +255
mj	micro justification	alignment by inserting fine spaces between characters
nf	next file	links document files
pl	page length	1-255
pn	page numbering	used with headers or footers
pi	pitch	10,12,15 chars/in.
ps	proportional spacing	needs printer support
ra	right alignment	On/Off
rm	set right margin	5-255
sf	sheet feeder control	
tm	top margin	0-255
vi	vertical spacing	1/48in. to 14/48in. per line

Table 1. Wordplus-PC formatting commands.

Help screens or disc directories may be accessed without interrupting an edit session. Because the function for saving or recalling files allows the option to copy a file name from the cursor position to the command line, a directory may be used as a file-selection menu. Now help screen may be added to the system; they could be useful for holding formatting standards or printer-control information.

Most features are accessed through the use of function keys, either alone or combined with the Shift or Alt keys. This is not a package for those touch-typists who dislike moving their fingers from the home-key position. Invoking a function often leads to a prompt for the selection of an option. For instance the function Disk is accessed by hitting F2. This produces the prompt

Recall, Store, Options

with the letters R, S, and O blinking. Typing S to store the current text to disc leads to a prompt

Drive?

entering B causes the system to respond with

Name?

You enter the file name, if it already exists a further prompt is displayed

Replace (Y/N)?

The operations on text objects are sensibly chosen to reflect editing needs. The Delete command selectively deletes a line, a word, a sentence or a paragraph. A text block of up to 41 lines may be marked using the Range feature; it can then be deleted, or transferred to any point in the current file in memory, or duplicated anywhere in this file or another which may subsequently be loaded. Both these functions result in some slow character-by-character scrolling on the screen while the operation takes place.

Larger blocks may be manipulated using Section Store and Recall, which lets you store on disc parts of the text currently in memory and copy files already on disc into the current memory text. Using cut and paste, a box of text — such as a column of figures — may be outlined and then moved to a new position on the screen. Both Locate and Search and Replace operate on a string of up to 16 characters. You can Search and Replace on a series of linked disc files. Files are loaded, scrolled up the screen, stopped for a session of character-by-character deletion and insertion, then scrolled again while the next change is sought.

Tab stops

Tab stop positions can very easily be set and reset and provide a means of speeding cursor movement along a line. A nice feature is the way Tab stops can be used with Numeric mode, allowing decimal alignment on the Tab positions. Backspace or overstrike commands, special ASCII characters and printer-control sequences can all be embedded in the text.

Special characters generated by the function keys let you underline subscript and superscript or make bold text. Underlined and bold text both show up well on the screen. There is a whole gamut of document-formatting commands, shown in table 1. The default values cannot be changed, but if they are not appropriate the appropriate commands are embedded in the text. Some of the features depend on capabilities of the printer being used and on the capability of Wordplus-PC to communicate successfully with it. My Epson can support many of them, but not all of them work correctly with this software.

A neat feature is the Video function which causes the formatted document to be displayed on the screen. If the output is too wide for the screen, horizontal scrolling may be used. It is particularly useful for checking layout and finding errors in the format commands, which in a large document could otherwise cause many false starts and much wasted paper.

Output can be printed from memory or from disc. Because disc files can be linked there is no limit to the size of a document. Among the print options is one that enables a range of pages to be printed. You can use this facility, for example, to print out only those pages which have been changed during the most recent edit. There is also a Multiple Copy option. While a document is being printed from disc files may be loaded, edited and stored again.

The Merge feature allows up to 32 separately identifiable fields to be merged into the text being printed. This is perfectly suited to the production of standard mail-shot letters. Any number may be personalised automatically by merging in address information, personal name, and other data which is held on the separate merge file.

Spacing varies

Wordplus-PC normally gives variable spacing for the merged input fields, so four character positions are provided for "Jane" and 11 for "Christopher". There is also the option to define fixed spacing, allowing the use of formatted tables or pre-printed stationery. In the receiving text it is possible to define fixed-length fields with left, right or central alignment.

The merge file may be generated, albeit rather laboriously, using Wordplus itself, or may be created by an external program. Three types of input-file format are catered for, and provided records are no longer than 255 characters it should be possible to use such a file. There is also provision for reading in data from a spreadsheet.

Most people will actually want to try out a word-processing package before making their choice. I tried Wordplus-PC and liked it, especially the uncluttered screen display, the use of the PC's keyboard and a range of features that fit most of my needs.

One measure of effectiveness that can be used in evaluating a word processor is to count the number of keystrokes used in making the required corrections to a document. This puts at a disadvantage those packages that do not have cursor control that will skip to the next word, the next sentence, or the next paragraph. By judicious use of the Tab facility, and by the

(continued on next page)

```
>cl:wordrev0 - first part of wordplus-PC review
>tm3:bm3:lm10:rm130:pl66

INTRODUCTION

Wordplus-PC is one of more than 30 word-processing tools currently available
in the UK for the IBM PC user. Unlike many others, this package is developed
specifically for the IBM PC and hence is relatively new - it was first
available in the US in early 1983 and arrived in Britain some months later.
From the outset the software should work comfortably with the computer for
which it was designed, and its features should match users' response to
competing packages that have been available for a longer time. This all goes
to make Wordplus-PC a possible front-runner among IBM PC word-processors.

There are four representative types of word-processor user:- an author
producing long continuous articles, a sales person doing mass mailing of
standard letters, a secretary typing many short personalized letters, and a
newsletter editor concerned about document merging and exact formatting.
Wordplus-PC is well suited the the secretary and the salesman, and may cover
many of the needs of the author and the editor too.

================================================================================
Wordplus-PC              L: 024  C: 41        CL   RANGE              INSERT
WORDREV3          001    CONTINUOUS    ALL TEXT        FROM DISK  TO PRINTER
```

Figure 1. The bottom two lines give status information: the cursor is at line 24, column 41, Caps Lock is On, and Wordrev 3 is being printed.

(continued from previous page)

use of Pg Up and Pg Dn keys — which are not too easy to control because of the fast scrolling — Wordplus-PC can hold its own with many of the non-mouse packages.

One feature which is missing is the ability to view and edit more than one piece of text at once. You cannot edit files created and used elsewhere — in source programs for instance — and there are several features connected with assembling large reports which Wordplus lacks. You cannot assemble a document during printing or generate ordered lists automatically. There are no facilities for footnotes, index generation, different treatment of left-hand and right-hand pages or levels of headings with auto-numbering.

The latest release of Wordplus-PC, which we were unable to get hold of in time for this review, comes with a graphics-drawing ability and spelling checker. It is said to operate on phonetic principles, and has a dictionary of 90,000 English spellings with space for 10,000 user-defined words.

In the U.S. the package is reputably selling well through heavy advertising in specialist IBM PC magazines using the slogan "The End of Wordprocessor Confusion". If this is a problem you suffer from and you are looking for an easy-to-use general-purpose word-processor then you should take a look at Wordplus-PC.

Conclusions

● Wordplus-PC is a good general-purpose word-processing package with a well considered spread of editing and formatting features.

● It is very easy to learn and friendly to use.

● Good file-merging facilities form part of the basic package.

● There remain some doubts about Wordplus's resilience, though some of its bugs may be cleared up in the current release. There is no Auto Save facility to write memory text back to disc, and several times I lost my latest changes when I inexplicably became locked out of the system.

● At £399 plus VAT Wordplus offers reasonable value for money.

● Wordplus-PC is available in the U.K. from Kobra Micromarketing, Unit 8, 1-7 Broomfield Road, London W13 9AP. Telephone: 01-997 6666.

MULTIMATE

A sophisticated package designed to resemble a Wang dedicated word processor.

MULTIMATE is a sophisticated American word processor which currently comes on three 5.25in. floppy discs containing some 76 files and 864K of code. However, the program is not as complex as the statistics make it sound. A large number of the files are for driving various printers, and there are 62 to choose from. There is also the built-in spelling checker with its *Webster's Dictionary* file, which takes up 218.5K of space.

Even so, the word-processing program itself is not small at 144.6K for the DOS-2 disc version reviewed. It requires at least 192K of RAM on an IBM, and may require more on a look-alike. Apparently, however, Multimate can be run on a 128K system under DOS-1.

Multimate opens with a main menu which offers a choice of 10 options numbered ranging from 1, to edit an old document, to 9 for returning to DOS. Creating a document involves filling in a Document Summary screen which records such information as the name, author, operator, keywords for identification, and several lines of comments if required.

Information added by the system includes the creation date, the last date the document was modified, the number of keystrokes used in the last session, and the total number of keystrokes used. These could be attractive to anyone running, say, a typing pool, though I'm told typists are far too smart not to find ways round this sort of feature. Their value to the ordinary user is that these screens provide a record of the files on a disc, something which after a few weeks it is almost impossible to garner from cryptic eight-character file names.

Each Document Summary screen can be printed out in front of its respective file. After this, pressing F10 takes you into the document you wish to write or correct.

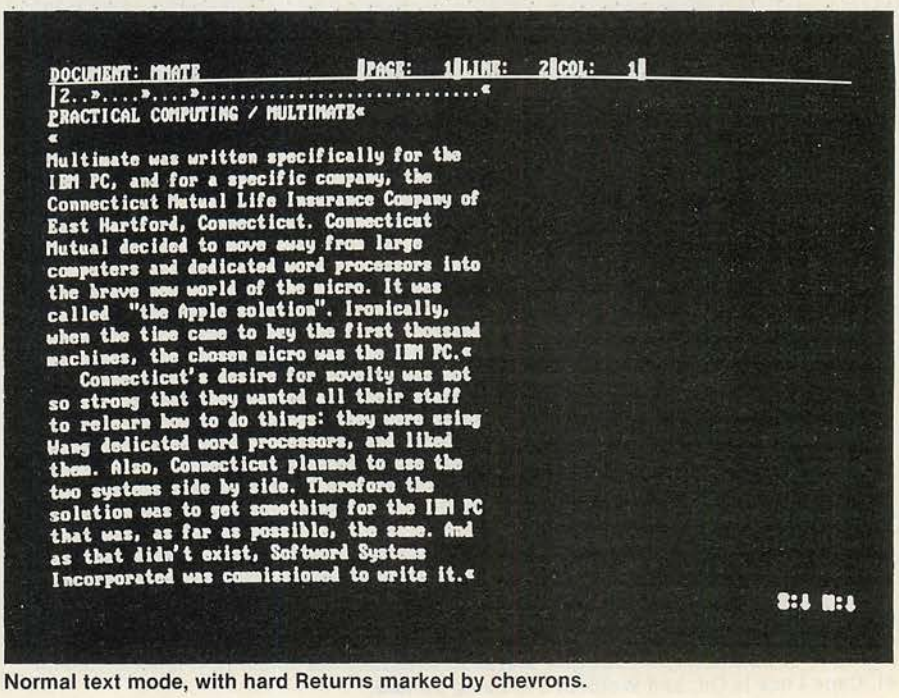
Multimate is radically different from the other two IBM PC word processors reviewed here, in being page orientated. First you open a document and start a page. When that page is full, Multimate writes the text to disc and opens another page, and so on. Very little text is held in memory unless you are planning to print it on to a very large sheet of paper.

Imposed stops

In the *Practical Computing* office we produce double-spaced text with about 30 lines to a page, and only up to 45 characters per line. As a result, the flow of inspiration was forcibly halted every few minutes while Multimate wrote text to disc. This became even more of a problem when correcting text, inserting and deleting lines all over the place, moving blocks of copy and so on, especially when working on a paragraph that straddled a page break.

The package performed all these functions impeccably, but all the pages were thrown out of kilter, requiring Ctrl-F2 to be pressed so that the repagination sequence could be performed. This took about only five seconds per page on average, but it amounted to a wait of a couple of minutes with this particular text. And remember, we were running Multimate from a hard disc; using a slower floppy-disc version must be tedious.

There are some advantages to the paged text approach. For one thing, it is hard to lose more than a page of text, and Multimate is commendably rugged in this respect. It suits the secretary and the copy-typist who needs to know exactly what appears on which page, and it can be a



Normal text mode, with hard Returns marked by chevrons.

boon to the author working on a book. Rather than scrolling through masses and masses of verbiage, you can press F1 and, in response to the prompt

Go to Where?

you are whisked to whatever page takes your fancy.

But for all that it must be said it is not so good for the reviewer — or at least, this reviewer — who wants the whole text in memory for cut-and-paste and all the messing about involved in trying to produce a coherent article.

In other respects Multimate is an outstanding package. The helpfulness of the manual and screen prompts will be touched on later, and Multimate has many other features that could with advantage be added to other word processors.

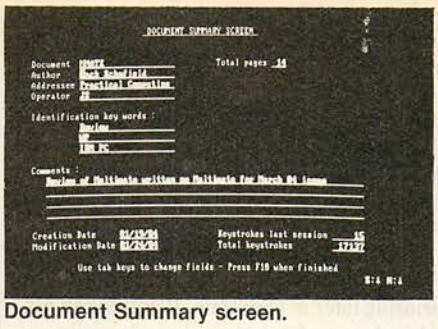
The Format line at the top of the screen always tells you the page, line and column number of the cursor, for example. In the bottom right-hand corner of the screen there are the letters S: and N: which, with an arrow, tell you if Caps Lock and Num Lock are set on the IBM keyboard.

Inserting text

When you press the Ins key to insert, the existing text after the cursor disappears, as usual. In Multimate, however, the continuation is written at the bottom of the screen, to remind you how the text continues. Also, all the text entered while inserting shows brighter on the screen, so you can change your mind about an insertion while you can still see what you have inserted.

Deletion is also very well implemented. Pressing the Del key highlights the character at the cursor. When you move the cursor all further text between where the cursor is and where it was, is highlighted, so you can see exactly what you are about to delete and how well the remaining ends of the text join together. Pressing Del once again instantly removes all the highlighted text.

Finally, underline is implemented using the Overstrike mode, so two characters occupy one space. In other words, you underline on the screen exactly as you would on a sheet of typing paper.



Document Summary screen.

The current user manual is for the 3.10/3.11 version, with a substantial paperback of corrections and enhancements. However, a card assures the buyer a 3.20 manual will be despatched when ready.

The manual is slightly larger than a PC-DOS v2 manual, and about as thick. It is beautifully printed, and ring-bound in a luxury padded cover. It includes a section on getting started, plus four separate training lessons to teach the use of the package. There are also sections on the utilities, a glossary and an index.

With the 3.20 update paperback the documentation is superb. You are not treated like an idiot, but nonetheless full details are provided for everything you need to do. There are also numerous screen displays reproduced in a second colour. Each point is numbered, and explanations are given where required. To quote an example more or less at random, you might be told: "2. Press the Delete (Del) function key. It's immediately to the right of the Ins key." This is followed by a long explanation of what the Delete key does.

It all contrasts wonderfully with standard computer manuals. Normally they either don't tell you exactly what to do — just enough to confuse you — or else blithely say "Press the Blip key three times" when, no matter how long you look for it, there just isn't a Blip key on the keyboard.

If you ever do get stuck, the Multimate manual's reference section is also excellent. It provides direct instructions down one side of each page, and notes on the other. For example, if you want to move text, the instruction says: "2. Press the Move function key (F7)." The Note column adds, "The system will prompt MOVE WHAT? in the upper right-hand corner of the screen."

In use the program is very well supported by Help screens that can be called up from disc, as with Microsoft's Word. However, the Multimate manual is so well put together it seems a shame not to read it.

Customised keys

Like most new IBM word-processing packages, Multimate comes with a sheet of sticky labels to customise the keyboard. Because we were chopping and changing between different word processors on a single IBM PC the stickers were not used. Multimate is a powerful package, with around 100 commands, and under these circumstances the key codes take a bit of effort to remember.

Instead of using mnemonics, the program mostly uses the dedicated function keys, often in conjunction with Alt, Ctrl or Shift so you start by using the manual a lot. However, there is consistency in the choices. The F2 key is used for page commands: F2 inserts a page break, Shift-F2 combines pages, Alt-F2 tells you the page length and Ctrl-F2 starts repagination.

Other facilities include the usual Search and Replace, horizontal scrolling, merging text from disc, a library routine for storing frequently used headers like your address or whatever, plus both horizontal and vertical addition using the built-in calculator. There is also a spelling checker.

Without the key labels, Multimate is harder to learn than Trendtext, Wordpro Plus or even Microsoft Word, when these are also used without labels. However, it is not particularly difficult to practice.

Detail

The only time I was caught out was when I followed the instruction to use Shift-3 for automatic page numbering. This printed a £ sign at the top of each page. On the U.K. keyboard, the # sign has been moved next to the Return key. Multimate has so many commands it is not possible to describe them all. However, their implementation shows an attention to detail which makes the program a pleasure to use.

To run the spelling checker it is necessary to exit from the text and select 0 from the main menu. You then have to wait while your words are processed, and the screen tells you how many words have been counted, and how many misspelled or, more correctly, how many are not recognised.

To see these words you have to get back into the document, where you now find a winking marker at the start of each dubious

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The Multimate solution

Multimate was written specifically for the IBM PC, and for a specific company, the Connecticut Mutual Life Insurance Company of East Hartford, Connecticut. Connecticut Mutual decided to move away from large computers and dedicated word processors into the brave new world of the micro. It was called "the Apple solution". Ironically, when the time came to buy the first 1,000 machines, the chosen micro was the IBM PC.

Connecticut's desire for novelty was not so strong that all the staff were forced to relearn how to do things. They were already using Wang dedicated word processors and liked them, and Connecticut planned to use the two systems side by side. The solution was to get something for the IBM PC that was, as far as possible, the same. It didn't exist, so Softword Systems Incorporated was commissioned to write it.

Naturally there were other companies with similar problems and similar needs, so it was not long before Multimate went on general sale to cater for them. After various updates, some of which represent radical improvements, we are now up to version 3.20.

(continued from previous page)
word. You can then ignore the misspelling, or correct the word.

If you like, Multimate will suggest words it has in its dictionary that your word might be. If it is a new word, you can ask for it to be added to the dictionary. All of this is very easily done under menu control. The spellings are, of course, American, so "colour" is marked wrong and it suggests "customise" should have a z. However, this causes surprisingly few problems in practice.

Printing

Printing with Multimate is controlled partly by the settings on the format line within the text, and partly by a menu screen which is held with appropriate default values. One of the strengths of the package is that you can insert format lines where you like inside the text. This solves the problem experienced with Trendtext, which led to involved printing out using chained files. However, it also creates problems if the overall settings on the menu and the format lines are incompatible.

I'm sure it should not be blamed on Multimate, but I had terrible problems printing out the text of this article. Sometimes I got half a page of copy per page, sometimes I got stray blank pages between each page, and sometimes my page breaks did not coincide with the perforations in the paper.

On another memorable occasion, I somehow managed to get the first 10 lines of an article mistaken for a header, and studiously printed at the top of about 15 pages of copy. This is the one case where the manual makes it sound easy — and probably it is — but a lot of paper can pass under the rollers before the right result is obtained.

One nice feature of the printing routine is that it allows texts to be spooled for printing later at a set time. Printing can also take place in Background mode while you are working on another text — but not the one you are printing. Someone with more confidence in their printers than we have could leave the PC to print out a day's work after shutting up shop and going home for the evening. The Print Spool Queue can be edited, so you can interrupt the printing of one document, move another to the head of the queue, then resume printing of the old one.

One thing you see very little of in Multimate is error messages. If you get them, phone CBIS for an answer. During this review I did manage to crash the system while repaginating the text, and got an Out of Record Space error message. CBIS responded promptly with the information that there was a bug here which was being fixed. So no complaints about back-up.

Before phoning I indulged in a certain amount of random key-pressing, then rebooted the system using Alt-Ctrl-Del. When I re-repaginated the text with a different number of lines per page the system recovered and worked. I never lost any text, and that, surely, is a compliment to any word processor.

Conclusions

● Multimate is powerful, with many attractive features which are well implemented and therefore easy to use.

● The system seems rugged. It appears to be well supported by CBIS, which also supports the package in America, where it has much greater market penetration.

● The documentation is of the highest quality, though spoiled at the moment by being in the form of a manual plus an update. When the new manual arrives there should be no cause for complaint.

● If you are a fast writer and heavy corrector you will probably hate the restrictions imposed by having to work in pages. A partial solution is to start with large pages and repaginate at the end, but nonetheless it is restricting to someone used to having the whole text in memory. Others who work in different ways with different kinds of text may find it an advantage rather than a disadvantage.

● Multimate is supplied by CBIS Corporation, 50 Pall Mall, London SW1Y 5JH. Telephone: 01-930 2647. It is available for the IBM PC only and costs £346.50 plus VAT.

● It has a £ sign.

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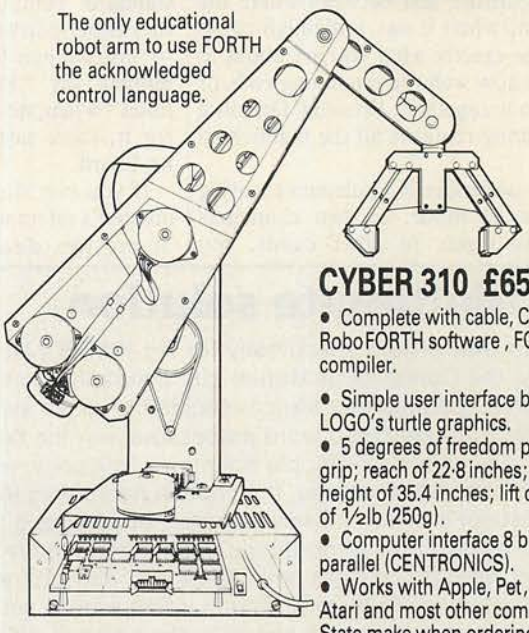

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Which one to choose?

CHOOSING a word processor is far from easy. There are so many packages available: dozens run under CP/M and there are around 100 for the IBM PC alone. Even small micros like the Atari, Acorn BBC and Commodore 64 are getting into double figures. Obviously it is no longer possible to provide a complete listing of the packages available.

The following non-comprehensive listing will, however, help anyone who needs a word-processing package, or just wants to see what is available. Preference has been given to programs which have been reviewed in *Practical Computing*, or which are particularly interesting — such as Microsoft's Word and The Final Word. We have also tried to list at least one package for most of the popular machines — even the Sinclair ZX-81 is not forgotten.

ALPHATEXT
Menu-driven word processor with calculator and database-type facilities
Runs on: Adler Alphatronic P3 and P4
Price: £375 plus VAT
Supplier: Triumph Adler (U.K.) Ltd, 27 Goswell Road, London EC1M 7AJ. Telephone: 01-250 1717

APPLEWRITER II
Cheap, but by no means the nicest WP program for Apples
Runs on: Apple II, IIe, III
Price: £89-£119
Supplier: Apple Computers, Finway Road, Hemel Hempstead HP2 7PS. Telephone: (0442) 48151
Reviewed: *PC*, February 1983

APWRITER
Menu-driven text editor with filing facilities etc; written in Basic
Runs on: Epson HX-20
Price: £25
Supplier: AP Systems, 90-100 Brighton Road, Kingston, Surrey KT6 5PP
Reviewed: *PC* November 1983

ATARI WORD PROCESSOR
Disc-based program with excellent documentation
Runs on: Atari
Price: £100
Supplier: Atari International (U.K.) Ltd, Atari House, Railway Terrace, Slough, Berkshire. Telephone: (0753) 24561
Reviewed: See Atariwriter review, *PC* October 1983

ATARIWRITER
Easy-to-use but powerful ROM cartridge program; works with Mailshot program from Silicon Chip Ltd. Telephone: 01-549 6657
Runs on: Atari
Price: £65
Supplier: Atari International (U.K.), Atari House, Railway Terrace, Slough, Berkshire. Telephone: (0753) 24561
Reviewed: *PC* October 1983

BANK STREET WRITER
Disc-based program written by educationalists for use by non-specialists and children
Runs on: Apple II, Atari, Commodore 64
Supplier: Softsel
Reviewed: this issue, page 52

BITS WORD PROCESSING SYSTEM
Full-feature word processor which runs under the UCSD-P system
Runs on: IBM PC
Price: £250 plus VAT
Supplier: Boeing Computer Services, 19 Fitzroy Street, London W1. Telephone: 01-631 0808

BOS AUTOWRITER
Menu-driven word processor that integrates with the BOS Business Software office system
Runs on: BOS/5 and MBOS/5
Supplier: Microproducts Software (MPSL), 87-9 Saffron Hill, London EC1N 8QU. Telephone: 01-831 8811

CORRESPONDENT 20
ROM cartridge for the Epson HX-20
Runs on: Epson HX-20
Price: £85
Supplier: Epson (U.K.) Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 6UH. Telephone: 01-902 8892
Reviewed: *PC* November 1983

EASY SCRIPT
Powerful but easy-to-use program on disc, works with Easy Spell; by Precision Software
Runs on: Commodore 64, 500, 700
Price: £75 upwards
Supplier: Commodore, 675 Ajax Avenue, Trading Estate, Slough, Berkshire. Telephone: (0753) 79292
Reviewed: *PC* December 1983

EASY TABS
Easy-to-use package that works with the Easy Tabs accounting range
Runs on: CP/M, IBM PC
Price: £99
Supplier: Tabs, Sapers House, Chantry Way, Andover, Hampshire SP1 0PE. Telephone: (0264) 58933

EDWORD
Cassette or disc program written by teachers and intended for educational use
Runs on: Acorn BBC Micro
Price: £50
Supplier: Clwyd Technics, The Coach House, Kelsterton Road, Flint, Clwyd. Telephone: (0244) 816236
Reviewed: this issue, page 51

EXECUTIVE SECRETARY
User-friendly but slow package on disc
Runs on: Apple II, IBM PC, Olivetti, M-20
Supplier: Keen Computers, Minerva House, Spaniel Row, Nottingham NG1 6EP. Telephone: (0602) 412777
Reviewed: *PC* February 1983

FINAL WORD
Powerful package with two windows that can handle several texts at once; similar to Perfect Writer
Runs on: CP/M, IBM PC
Price: $300
Supplier: Mark of the Unicorn, PO Box 423, Arlington, Ma 02174, U.S.A. Telephone: (617) 576-2760

FORMAT 80
Disc-based package with clever features from Elite Software
Runs on: Apple II
Price: £35
Supplier: Personal Computers Ltd, 220-226 Bishopsgate, London EC2. Telephone: 01-377 1200
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HES WRITER
Professional-style packages for small Commodore micros; available on disc or cartridge
Runs on: Vic-20, Commodore 64
Supplier: Softsel, Softsel House, Central Way, Feltham, Middlesex TW14 0XQ. Telephone: 01-844 2040

HOMEWORD
Disc-based package using icons; intended for use at home or by children
Runs on: Apple, IBM PCjr, Atari
Supplier: Softsel — see HES Writer
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Cassette-based program that makes maximum use of the Epson's built-in LCD display
Runs on: Epson HX-20
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Runs on: IBM PC
Price: £346.50
Supplier: CBIS Corporation. Telephone: 01-930 2647
Reviewed: this issue, page 60

Word processing: directory

MYWORD
Versatile package with custom-tailoring of features available to user; also provides glossary facility and soft keyboard
Runs on: IBM PC
Price: £295 plus VAT
Supplier: Software City, 43 West Street, Dorking, Surrey RH4 1BU. Telephone: (0306) 886442

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Versatile disc-based package with arithmetic and mailing functions; lacks word-wrap
Runs on: Commodore 64
Price: £86
Supplier: Kobra Micromarketing, Unit 8, 1-7 Broomfield Road, London W13 9AP. Telephone: 01-997 6666
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PEACHTEXT
Old-established program with spelling checker, mail manager and Peachtree suite including Peachcalc
Runs on: CP/M, IBM PC
Price: £250
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PERFECT WRITER
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QUICK BROWN FOX
Cartridge-based package which also provides 80-column screen
Runs on: Commodore 64, Vic-20
Price: £60
Supplier: SPT Electronics. Telephone: (0621) 868484
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QUICKSILVA WORD PROCESSOR
Unsophisticated but cheap cassette-based program for the Sinclair Spectrum
Runs on: Sinclair Spectrum
Price: £5.95
Supplier: Quicksilva, 13 Palmerston Road, Southampton
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SCRIPT 64
Disc-based package with simple calculator mode and built-in spelling checker
Runs on: Commodore 64
Price: £78
Supplier: Impex Designs. Telephone: 01-900 0999
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SIMPLY WRITE
Good value disc-based package with mailing list facilities
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Price: £249
Supplier: Precision Software, 4 Park Terrace, Worcester Park, Surrey. Telephone: 01-330 7166
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Includes maths and decimal tab, on disc for the Apple
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Cassette-based programs for the Sinclair Spectrum and ZX-81, since superseded by Tasword 2 for Spectrum which offers 64 characters per line
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Runs on: CP/M and IBM PC
Supplier: Microtrend U.K., Council Chambers, School Lane, Pately Bridge, Harrogate, West Yorkshire HG3 5DF. Telephone: (0423) 711877
Reviewed: this issue, page 56

UNIPLEX
Full-function package with mailing list and spelling checker; also available for non-English language users
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Supplier: Redwood International, 2 High Street, St. Albans, Hertfordshire

VER-WORD
Runs on: CP/M
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Program available on tape or disc
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Runs on: Acorn BBC Micro
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VISIWORD
Part of the Visi suite of programs; Visi On Word will be integrated with Visi On
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Supplier: Rapid Terminals, Rapid House, Denmark Street, High Wycombe, Buckinghamshire. Telephone: (0494) 26271.

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User-friendly disc-based package with spelling checker; links with Vizastar
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VOLKSWRITER
Easy-to-learn word processor written for the IBM PC, includes tutorial; foreign versions available
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WORDCRAFT 20
ROM-cartridge program with a wide range of facilities
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WORDCRAFT 40
Cartridge-based program adapted from Wordcraft 80 on the Pet
Runs on: Commodore 64
Price: £90
Supplier: Audiogenic — see Wordcraft 20
Reviewed: *PC* December 1983

WORDPRO
Disc-based program which uses a dongle for protection; lacks word-wrap; can handle mail-shots
Runs on: Commodore Pet
Price: £395
Supplier: Wego Computers, 22a High St, Caterham, Surrey CR3 5UA. Telephone: (0883) 49235
Reviewed: *PC* May 1983

WORDPRO 3-PLUS/64
Disc-based package with simple calculator; lacks word-wrap
Runs on: Commodore 64
Price: £80
Supplier: Wego Computers — See Wordpro
Reviewed: *PC* December 1983

WORDPLUS-PC
Disc-based package from Professional Software Inc.; spelling checker available, Boss
Runs on: IBM PC
Price: £399 plus VAT
Supplier: Kobra Micromarketing — see Paperclip
Reviewed: this issue, page 58

WORDSTAR
Powerful word processor which runs mainly under CP/M and has become the de facto industry standard; part of extensive Star range
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Price: £250
Supplier: Micropro International, 31 Dover Street, London W1
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WORDWISE
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Runs on: Acorn BBC Micro
Price: £35
Supplier: Computer Concepts
Reviewed: *PC* August 1983

WP2020
Powerful disc-based program which forms the basis of the office-management package O-Man
Runs on: CP/M, IBM PC
Price: £350
Supplier: Graffcom Systems Ltd, 7 Rickett Street, London SW6. Telephone: 01-385 9422

XED
User-friendly package from Computer Methods
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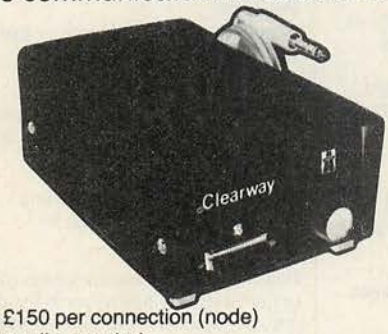

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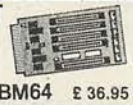

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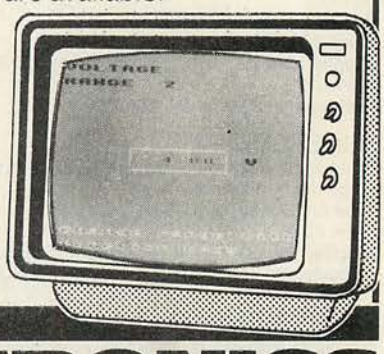

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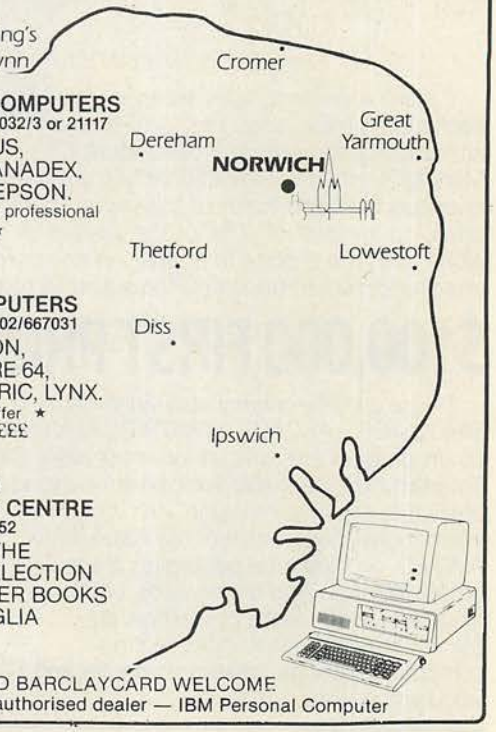

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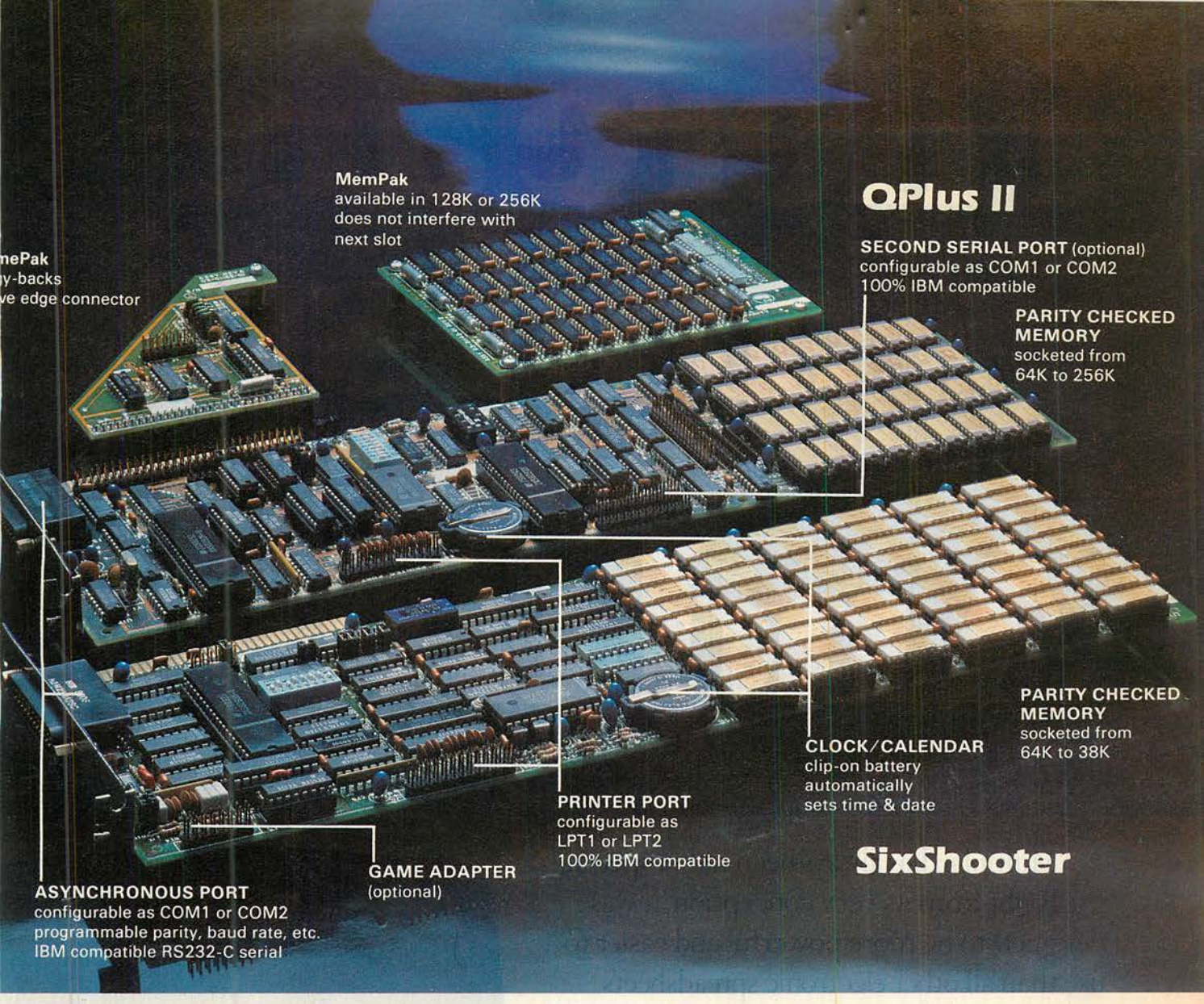

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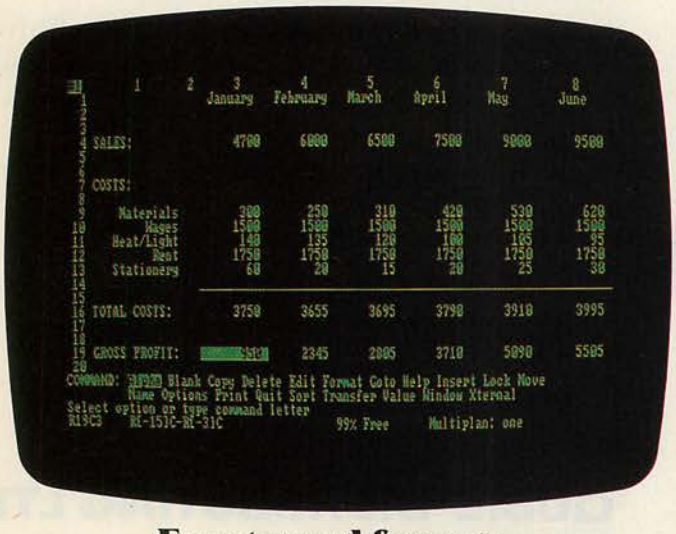

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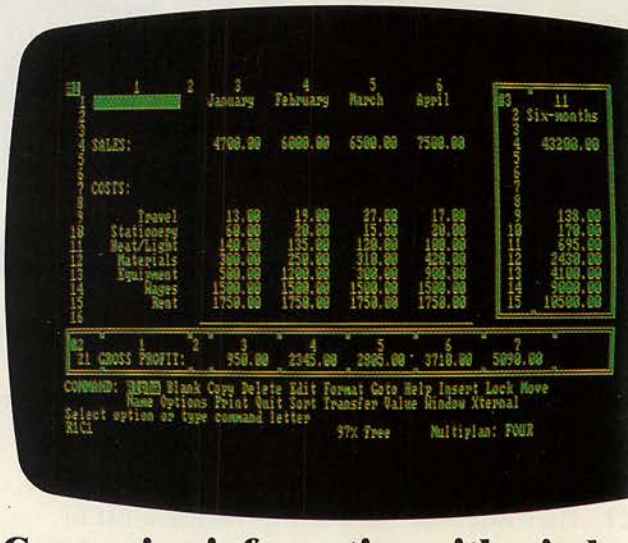

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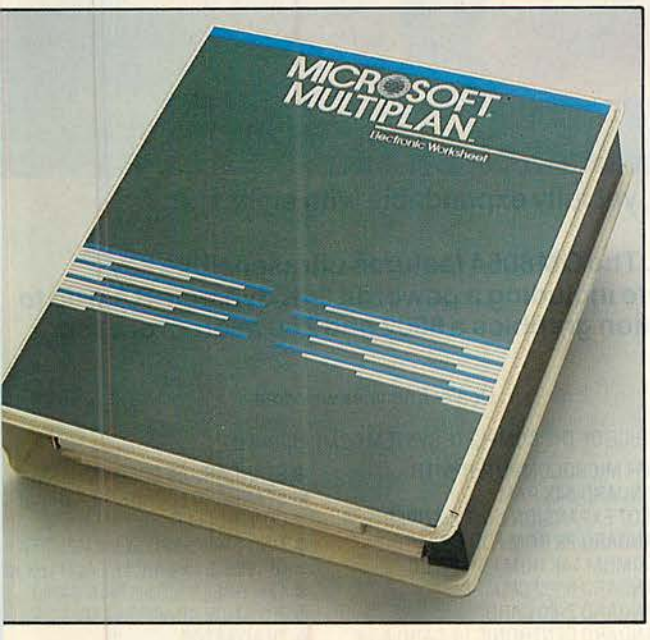

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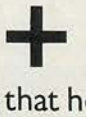

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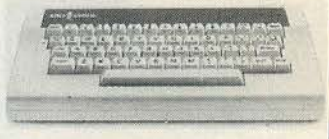

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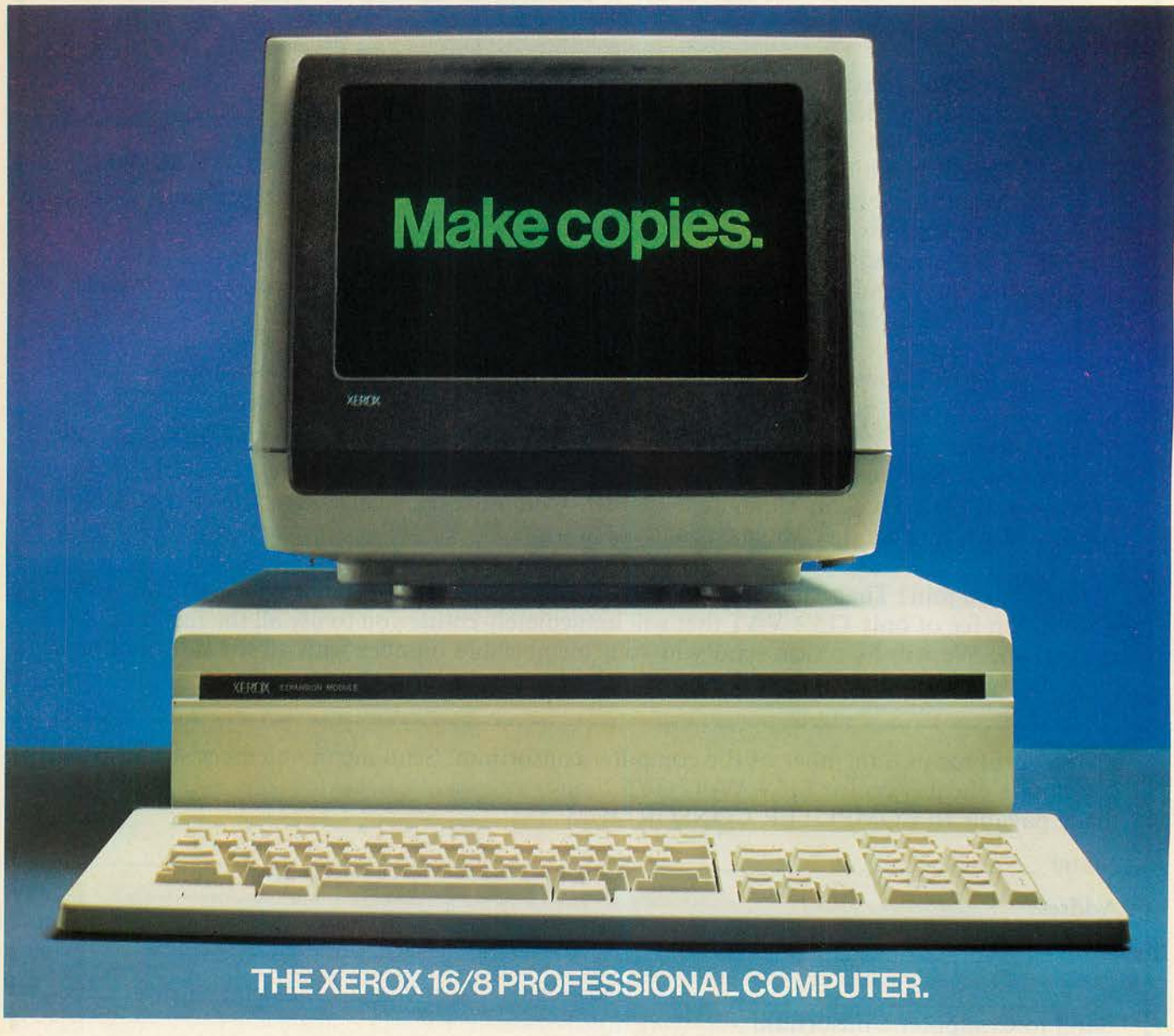

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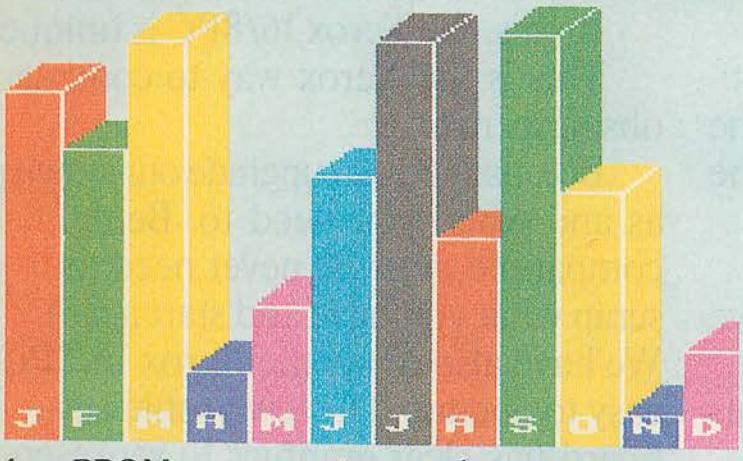

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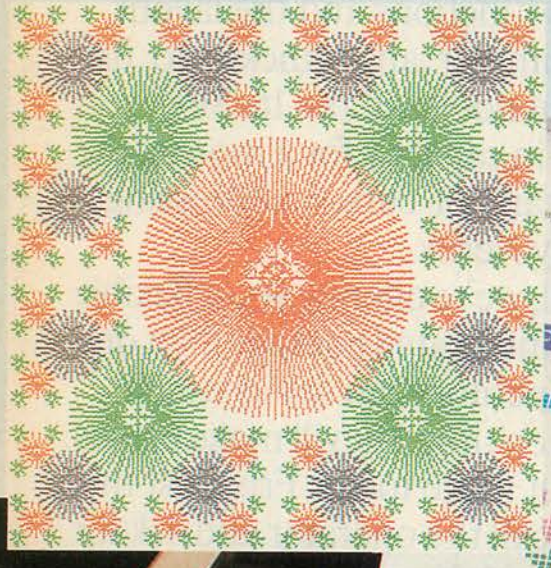

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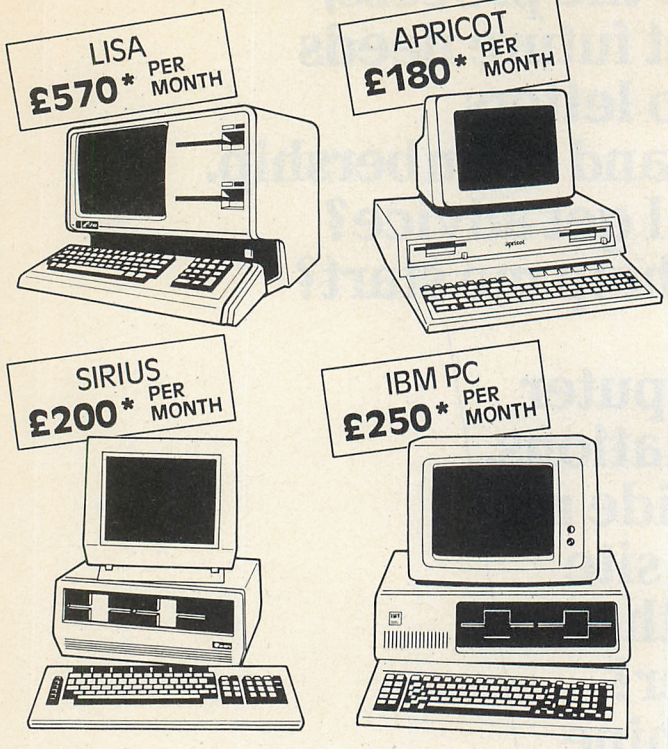

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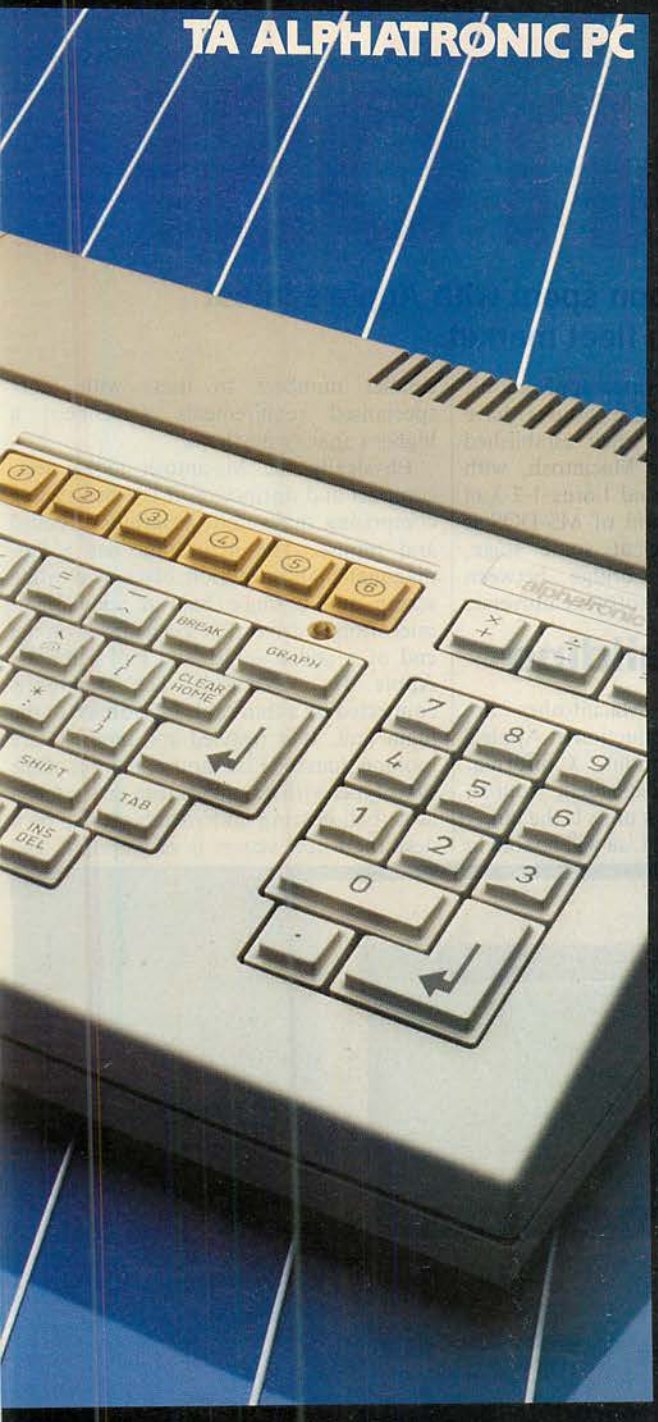
C means business



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APPLE MACINTOSH

Ian Stobie reports on an afternoon spent with Apple's latest contender for the fleet market.

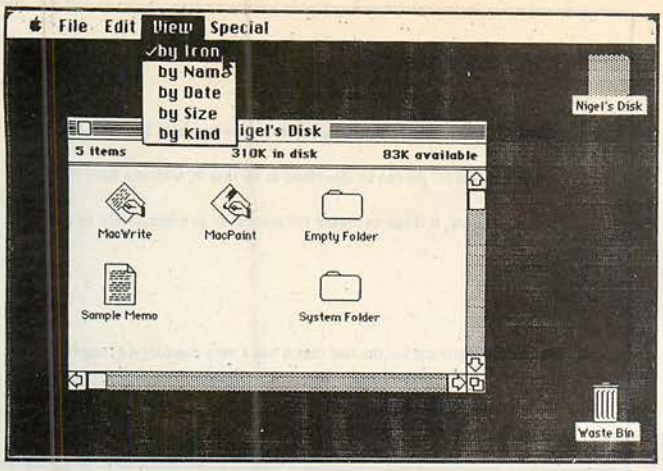
AT FIRST glance the Macintosh seems to be a junior version of Apple's Lisa — a smaller, portable Lisa which will probably sell for around £1,500. But the Macintosh is far more important to Apple than this. It is intended to be Apple's main mass-market office computer: the key machine if the company is to have any chance of defending its position against IBM.

In spite of the pressures on Apple, which has slipped to number 2 behind IBM in the PC market, the company has kept its nerve. The Macintosh continues the independent architecture pioneered with the Lisa — it is not a standard MS-DOS, CP/M or Unix machine. This time Apple has taken steps to ensure a larger amount of independent software for the machine in addition to the initial range of Apple-written applications. Some 25 major software houses have signed deals to transfer their established packages across to the Macintosh, with Microsoft's Multiplan and Lotus 1-2-3 in the first batch. A version of MS-DOS is likely to be available at some stage, providing a broader bridge between Macintosh and the IBM software universe.

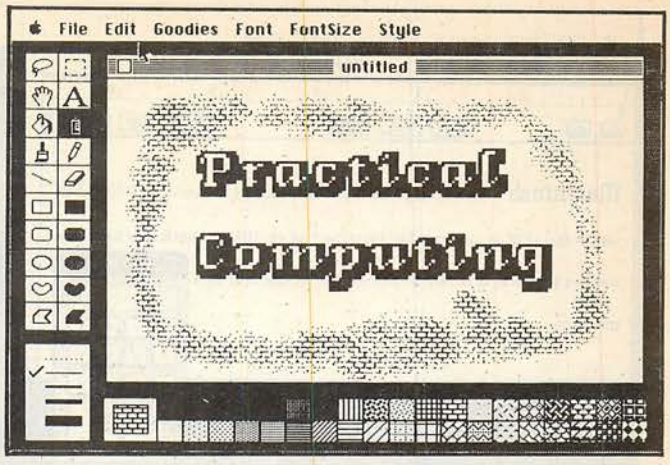
Volume building

Huge volumes of Macintoshes are reputedly going into production at Apple's new factory in Freemont, California. According to one independent source, upwards of half a million units is the target for 1984. Meanwhile the Lisa will be sold in smaller numbers to users with more specialised requirements who need a higher-capacity machine.

Physically the Macintosh looks neat compact and distinctive. It is a box system comprising main unit, separate keyboard and mouse. The main unit has a 9in diagonal high-resolution black and white screen and a single built-in Sony 3.5in microfloppy drive. The keyboard is on the end of a coiled cable, and looks like the Apple IIe keyboard. The mouse is connected by a thin cable to the back of the main unit. It is restyled and more square looking than the Lisa mouse, but it is of the same type, with a single button on top and a large ball-bearing underneath. Set up on a desk the whole system is very upright, and



The Macintosh presents a very similar face to the user as the Lisa, with multiple windows, high-resolution graphics symbols and pop-down menus. Here a window has just been opened up to see what is on a disc called Nigel's disc. This is an accurate dump of the screen, produced on the Macintosh printer.



The Macpaint aerosol can has been selected from the set of painting tools shown down the left-hand side of the screen together with a brick-wall pattern from the set of patterns shown along the bottom. Used in combination they sprayed a brick-wall pattern around lettering entered earlier as text.

looks unlike any other computer I have come across, the nearest being the Hewlett-Packard 150 and 200 series.

Together all three units weigh 21lb., and fit easily into the optional Macintosh carrying case. Setting the system up again is straightforward, since a power cable is all that is needed to connect up to the mains. Interestingly, Apple does not see portability as a particularly strong selling point — the design goal was to produce a machine of which vast numbers could sit on office desk tops. Therefore neatness and compactness matter most and portability is a side benefit. The main unit takes up the same space on a desk surface as an A4 pad.

Lisa-like

The other major feature which Apple hopes will appeal to office-equipment buyers is the easy-to-use Lisa-style software covering all the major office tasks — word processing, financial planning, scheduling and so on. Built into the Macintosh is VT-100 emulation software to allow it to take over the mainframe computer terminal's role.

There are probably about eight million office desks in the U.K. alone, plus 25 million in Europe and 50 million in the U.S. About seven percent of U.S. office workers presently use personal computers, so the potential for growth is enormous. All the design ideas embodied in the Macintosh attempt to exploit this marketing opportunity: it is not intended as a traditional data-processing machine but is meant to be a simple tool for office use. Apple would have us believe this kind of personal computer will soon be as accepted as the telephone.

Like the Lisa, the Macintosh is built around Motorola's powerful 68000 chip. This allows some multi-tasking capacity to be built in, and makes simultaneous handling of the mouse input device, the high-resolution graphics display and the main applications task a practical proposition at an acceptable speed. Eight-bit technology could not support the demands imposed by this level of highly graphic and interactive software.

The other major constraint on any systems performance is how much memory is available. The Macintosh comes with 128K of RAM as standard. This is supplemented by 64K of ROM, which contains the Lisa-like operating system and a host of useful routines for doing things like reading the mouse position or displaying windows.

The 128K of RAM available is good but not exceptional for a modern machine. Lisa comes with 1Mbyte, while the fundamental limitation imposed by the Motorola 68000's 24-bit wide address bus is 16Mbyte. The obvious question is why the user is not provided with more memory. The answer seems to be the world-wide shortage of RAM chips. When 256Kbit RAM chips become readily available the Macintosh will alsmost certainly be expandable internally to 512K. At the moment 128K looks like being both the standard and the maximum RAM for the Macintosh when it is launched. Of this 128K of memory, 85K is available for the user's applications.

Microfloppies

The Macintosh's built-in 3.5in. microfloppy has a formatted capacity of 400K and is single sided. The mechanism is bought in by Apple from Sony. The decision to use Sony discs suggests that the floppy-disc system Apple developed for the Lisa, which requires non-standard 5.25in. floppy media with two read/write slots in place of the usual one, will soon be dropped. A revised version of the Lisa with Sony discs seems likely.

The Macintosh comes fitted with a disc controller that will accept a second microfloppy drive plugged into the back of the machine. No hard disc is planned for the Macintosh at present, although it is an obvious product for a third-party supplier to offer.

On the back of the Macintosh are two high-performance RS-232 serial interfaces capable of transferring up to 1Mbit per second. One is configured as a printer interface, the other for communications. Apple itself is supplying only one printer for the machine, a 120 cps dot-matrix printer priced around £430. It is made by the Japanese C. Itoh company, but Apple has adapted it to print Macintosh graphics. In use it is surprisingly quick, and a good deal faster than the Lisa and its printer at dumping graphics. Apple says it will co-operate with a third-party printer supplier to get other printers working with the Macintosh.

Apple Bus

Details of Apple Bus, which will use the serial ports, will be announced some time after the Macintosh launch. Apple Bus is a low-cost alternative to the Ethernet-style network offered by the Lisa. It will allow you to connect up several Macintoshes, and to mix Macintoshes and Lisas in a local area network, along with other peripherals.

A lot of thought has gone into the design of the Macintosh. Both the main unit and keyboard have reinforced anchor points for anti-theft chains. There is no Reset button in the conventional sense; instead you have to push a separate plastic key through the side of the case to reset.

Getting inside the Macintosh is also not easy, and is not meant to be. You need an especially long Allen-key to get the casing off. Although a full technical manual will be available for the Macintosh, it is not an open system in hardware terms. Apple does not forsee a whole host of hardware add-ons, with users forever opening up the case to try out a new card as with the Apple II. Third-party add-ons will have to connect up externally through the serial ports or the disc-interface socket.

I am not sure whether the change of strategy is altogether a good idea. Third-party suppliers will be more restricted in what they can provide for the Macintosh.

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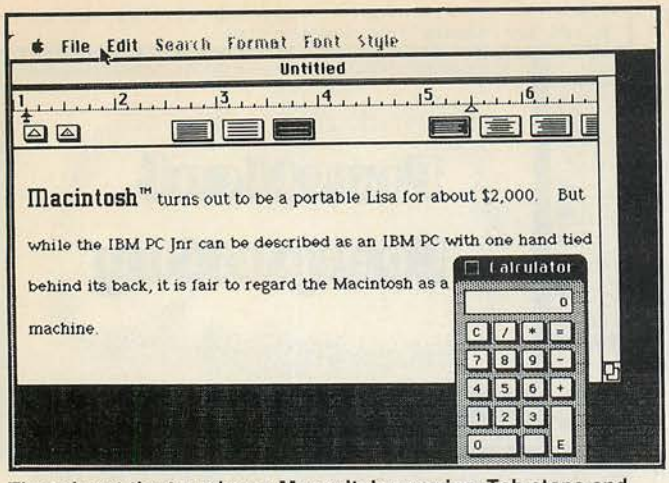
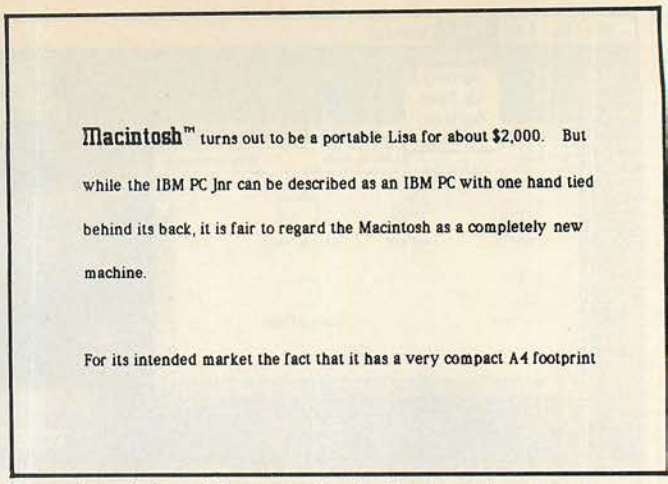


The ruler at the top shows Macwrite's margins, Tab stops and the spacing and formatting selected. This document is to be triple-spaced and justified left, so the appropriate symbols are emphasised in black. As with any other Macintosh application, while using Macwrite you can get out the calculator, the clock or other Macintosh tools to help.



Macwrite prints out the same text in the normal way, as a document. The Macintosh dot-matrix printer is adequate for correspondence. Apart from cost and the fact that it is the only compatible printer available yet, its advantage over a daisywheel printer is that it can handle all the Macintosh's graphics and typefaces.

(continued from previous page)

The Apple II's success owes a lot to the flexibility the user gained from a universe of add-ons which fitted into the seven free expansion slots. The fact that the Apple II series is now the most widespread CP/M system owes little to Apple's original concept and everything to the independent makers of add-on Z-80 processor cards. I would have thought that when taking on IBM, Apple needs all the allies it can get.

Turning the machine on, the first thing that comes up on the screen is a picture of a smiling face followed by a "Welcome to Macintosh" message. If you insert a disc, a detailed picture representing an empty desk top is displayed; on the desk top is a disc symbol with the name of the disc underneath it and a waste-basket symbol. If you move the cursor over the disc symbol using the mouse, the disc symbol opens up into a window showing what is on the disc.

Applications like Macpaint or Macwrite are initiated in the same way. Macpaint is an impressive drawing package, suitable for producing visual aids for presentations combining text, diagrams and graphics. Text is entered at the current cursor position using the keyboard, and can then be moved, enlarged and restyled in a variety of founts. You use the mouse to control a variety of drawing tools including a paintbrush, pencil and aerosol can — Macintosh displays an appropriate cursor in each case. Several ways of undoing work are provided, including a simulated eraser whereby you move a pencil-eraser symbol on the screen to rub out lines.

A palette is available for providing particular types of shape, like rectangles and circles. A rubber-band feature, which lets you stretch a line across from a fixed point and move it around until you are ready to fix the other end down, is particularly fun to use.

Macpaint is much faster in use than the equivalent Lisa package, Lisadraw, reviewed in *Practical Computing* August 1983, though the Lisa is a more powerful machine with hard disc and more memory. This is partly the result of the extra year the Apple software team have had since the Lisa to rethink things.

Single sheet

But Macpaint is more limited than Lisadraw in several ways. With Macpaint you work on a single sheet of paper, whereas Lisadraw allows you a large number of contiguous sheets to let you do true scale drawings. Further Macpaint is manipulating bit patterns rather than the stored parameters of graphic objects, which limits your ability to redraw things. But for the ordinary office, as opposed to the drawing office or studio, these limitations are not important, whereas the advantage of speed is. However, when duplicating entire documents — or making disc back-ups — the absence of a second disc drive slows the Macintosh down.

Macpaint and Macwrite will probably be bundled together and sold in the U.K. for about £100. Other Apple applications will be available at the time of the launch for other typical office tasks and will cost £99 each.

The Macintosh takes a significant step forward in terms of software integration. All the Apple-written packages work in similar ways and you can transfer data between them. But the big advance is that many of the third-party packages, including the Macintosh versions of well known established products, promise to have the ability to share data with the Apple applications and with each other.

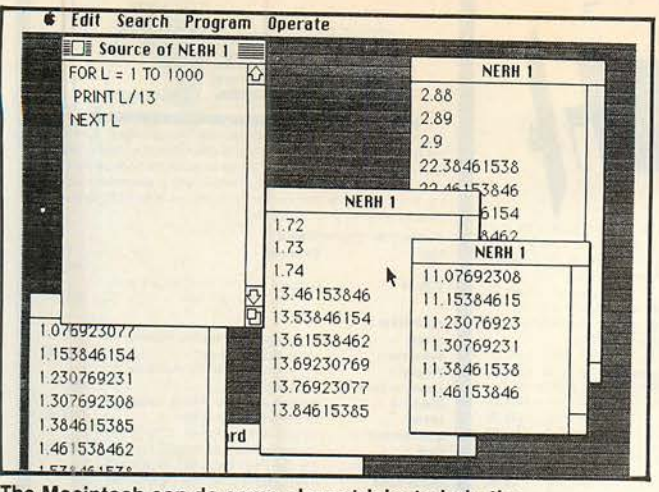
This ability is connected with the Macintosh's 64K of ROM. The entry points to all the routines in the ROM are being made public, and third-party suppliers are encouraged to use them when rewriting their software for the Macintosh. The ROM routines observe certain conventions for representing data. One part of the operating system, called Scrap Manager handles the cut and paste operations for applications like Macpaint and Macwrite. Scrap Manager recognises two formats for transferring data: pure ASCII text and graphic objects using Macintosh conventions.

Any package using Scrap Manager to manipulate data internally should also be able to transfer data across to another package that uses Scrap Manager. Most independent suppliers of Macintosh software will probably make extensive use of the ROM routines simply to shorten their development time and shorten the length of their code. The additional benefit to the end-user is the ability to move data between applications.

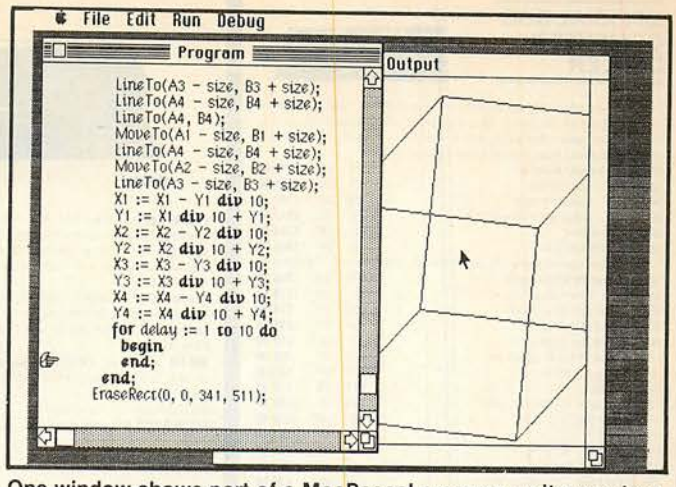
The initial two languages Apple will be offering for the Macintosh are impressive. MacBasic is a structured Basic; line numbers are optional and you can have labelled subroutines with named para

Specification

CPU: Motorola 68000 running at 8MHz.
RAM: 128K, for max RAM.
ROM: 64K containing operating system, user interface software and programming toolkit.
Display: 9in. diagonal CRT with high 512-by-342 dot resolution. Shows graphics and text in wide variety of type sizes and styles which can include 80-by-24 characters if you like.
Keyboard: Detached QWERTY-layout keyboard very similar to the Apple IIe's. All keys software redefinable. Optional numeric keypad available as separate unit.
Mouse: One-button rolling-ball type.
Discs: One 3.5in. Sony microfloppy drive built into main unit, single-sided, with formatted capacity of 400K. Optional external boxed 400K microfloppy drive. No hard disc at present.
Interfaces: Two RS-232 high-speed serial ports running at up to 1Mbit per second one configured for comms, the other for printer. External disc-interface. Sound output socket.



The Macintosh can do some clever tricks to help the programmer using MacBasic. Here one version of a short Basic program is shown in the window at the top left for editing. Four other windows show the output from various earlier versions of the program, which were all still running and displaying new results when this snapshot screen dump was taken.



One window shows part of a MacPascal program as it executes; the other shows the output, in this case an animated graphic of a rotating box. The little hand in the program's window shows the instruction currently being executed.

meters passed to them. Normally you would use Basic in conjunction with the routines in the Macintosh's ROM to handle the screen display. All the usual structured constructs are included.

The ability of the Macintosh to handle multiple windows helps when debugging programs. You can define a window for program output then run the program while you examine the code in another window. This is useful when using the single-stepping debugging aid. Although the Macintosh does not have the full multi-tasking abilities of the Lisa, you can run several small Basic programs simultaneously, with the output going to different windows. I did not have the opportunity to run our standard set of Benchmarks, but MacBasic is manifestly fast, as you would expect with a 68000-based system.

ortability: Weighs 21lb. Mains-powered. Optional carrying case available. Footprint on desk without keyboard is A4.

.K. price: Probably £1,500 for single-disc system with 128K of RAM, screen, keyboard and mouse. Application software is priced separately, but system disc, tutorial disc, owner's manual and tutorial audio cassette are included in the base price.

oftware: Apple-written packages will probably cost £99 each in the U.K., with Macpaint and Macwrite bundled together at a lower price. The initial list is Macwrite, Macpaint, Macproject, Macterminal, MacBasic, MacPascal, MacLogo, Macassembler. Other languages — C, Fortran, Cobol and Forth — are under development. Third-party software includes Multiplan, Lotus 1-2-3 and the PFS database series.

lanufacturer: Apple Computer Inc. Made in U.S.

.K. Distributor: Apple Computer (U.K.) Ltd, Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244. Available April 1984.

MacPascal is an interpreted Pascal. Syntax is checked as you type the program in, and you then run it without having to compile. MacPascal is source-code compatible with Lisa Pascal and programs can be easily transferred between the two types of machine via the serial link.

Rival micros

In hardware terms the Macintosh has no exact equivalent but there are other machines aimed at the same office-market slot, the most successful being the IBM PC. The Macintosh starts with a big price advantage: a system with a dot-matrix printer and a couple of applications probably works out at just over £2,000 compared to about £3,000 for a similar IBM set-up. As the IBM PC contains roughly five times as many components as the Macintosh the scope for cost reduction is not great. Admittedly, the Macintosh only has one disc drive, but I found this to be little problem in practice and for the general office user doing unambitious tasks the second drive should not be needed.

The IBM PC is very conventional compared to the Macintosh. To get a system running software with the same kind of data integration and ease of use, the real comparison is with either the Lisa or an IBM which is running Visi On. Visi On unfortunately requires a hard disc to run and is expensive. The cost works out at around £6,000 for either an IBM XT with Visi On software or the Lisa with some of its software. Although both these systems have much greater disc capacity, a Macintosh system at £2,000 probably offers just as much of what the typical office users want.

Conclusions

● The Macintosh is intended for the general office user, and packs a powerful but appropriate set of features into a neat, compact package. At around perhaps £2,000 for a complete system with printer and an application or two, it looks attractive against the competition.

● Employing similar concepts to the Lisa, the high-resolution graphics screen and the mouse are used to great effect by the system. It is genuinely easy to use.

● The single Sony microfloppy provides enough disc-storage capacity for what most people will want to do, but some users may need to add the extra disc drive. A hard disc does not seem to be planned at present by Apple; users requiring one may be steered away from the Macintosh to the Lisa or to an as yet unannounced machine — see news item on page 13 of this issue.

● Users requiring a daisywheel printer may have trouble getting one in the Macintosh's first few months. The Apple dot-matrix printer is fast, does graphics superbly but is only suitable for in-house memos and presentations.

● Macintosh's Apple-written software that we were able to examine is very good. Macpaint appears to be better than the equivalent Lisa package for the typical non-specialist office user. Macword is an up-to-date easy-to-use word processor.

● A good range of languages is planned for the Macintosh. The two we have seen, Basic and Pascal, have impressive features, and as well as being suitable for serious commercial programming will bring the Macintosh to the attention of scientific and educational users.

● Third-party software will be available for the Macintosh, including well establihsed packages such as Multiplan.

● It appears that much third-party software is being rewritten in such a way that data will be transferrable across to Apple-written packages. It should be emphasised that we had no opportunity to test this out, but if it works this is a tremendously useful ability.

● On the evidence of the Macintosh, Apple is still the most exciting computer company around.

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BBC Mod B + Econet interface	£389 + VAT	£447.35
BBC Mod B + disk and Econet interfaces	£450 + VAT	£517.50
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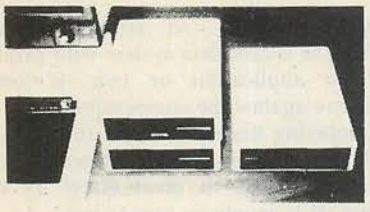

These drives are supplied ready cased with all the necessary cables, formating program and user disk system guide.

There are some useful utilities included, e.g. Epson Screen Dump Program, Memory Dump, Free, Duplicate, Merge and Relocate. Power consumption of these drives is very low (0.2A typ. at +12V, 0.4V typ. at +5V per drive). Power is taken from the BBC computer.

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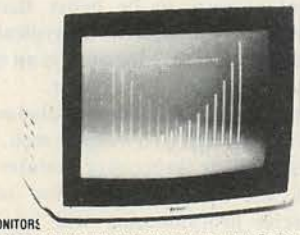

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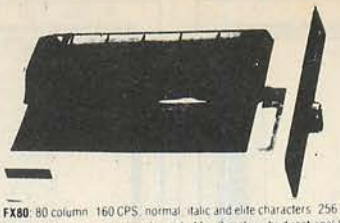

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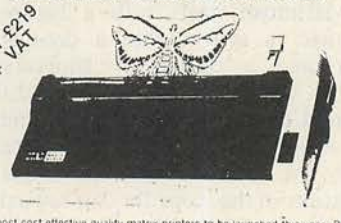

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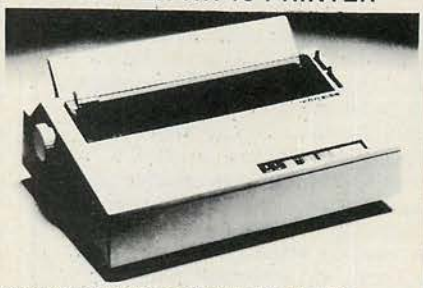

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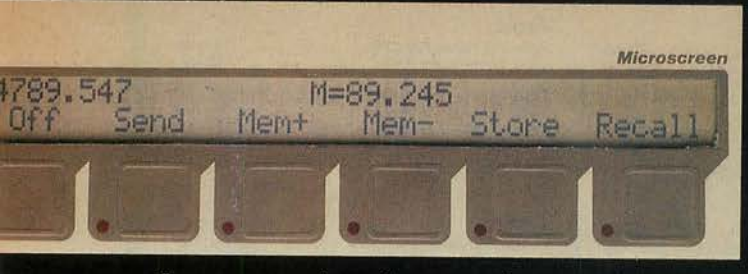

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UNITRON 2200

Roger Cullis was hard put to find any practical differences between the Apple IIe and its Taiwanese rival, except the built-in Z-80 card and disc controller — and the £389 price tag.

OBVIOUSLY DESIGNED to be compatible with the Apple II and II Plus, the Unitron 2200 incorporates many features which Apple should have included in the IIe. However, the differences are almost entirely mechanical and do not affect the Unitron's ability to run applications programs which have been developed for the Apple II.

The Unitron 2200 comes in two boxes: one for the keyboard and encoder, the other for the computer. They are connected by a coiled lead which plugs into a 15-pin D-connector socket in the main housing. The plastic case of the Unitron is thinner than the Apple's and not as robust. In particular, the guides for expansion-card ribbon cables are flimsy and could easily be snapped off.

The main housing is constructed in two parts held together by four mating pegs and sockets. You have to take great care not to break off the pegs when you take the case apart. There is no warning in the instruction manual, and I nearly did irreparable damage before I became aware of the problem.

Inside the case, there are some immediate differences between the Unitron 2200 and the Apple IIe, but they are superficial. The Unitron motherboard measures approximately 400mm. by 250mm., is blue and is made in Taiwan; the Apple PCB is 300mm. by 230mm., is green and is made in Singapore. The extra space accommodates the disc controller and Z-80 second processor circuits.

FCC standard

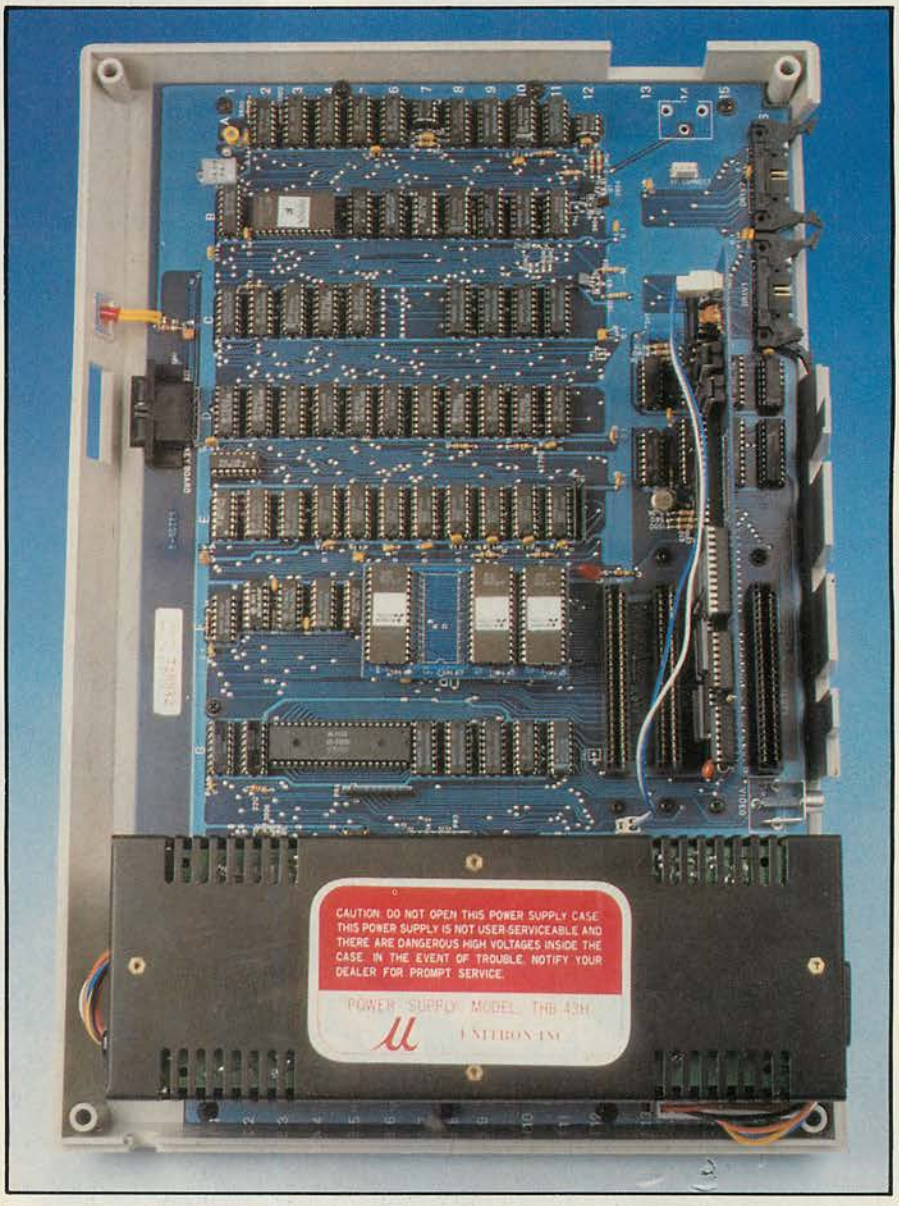
The Unitron has a switching power supply made in Taiwan and housed in a 250mm. by 89mm. by 57mm. black metal case, mounted on pedestals for free air circulation. The Apple has a switching power supply made in Hong Kong and housed in a 250mm. by 89mm. by 57mm. gold-coloured metal case, mounted directly on the metal base of the cabinet to dissipate heat. The case of the IIe has been constructed partly of metal in order to meet FCC radiation screening specifications; this refinement has not been provided on the Unitron.

The Unitron 2200 has only four expansion slots, compared to seven on the Apple IIe and eight on the II Plus. The connectors are labelled Slots 1, 3, 5 and 7. Slot 0 is omitted for the same reason that Slot 0 disappeared from the Apple IIe: 64K RAM chips are used for read/write memory so there is no longer any need to make provision for the language card. Slots 4 and 6 will not be missed since they are the conventional homes for a Z-80 second processor card and the disc controller respectively. These features are an optional extra with the Apple but form an integral part of the Unitron motherboard.

The absence of Slot 2 could prove more serious because this is the place for a communications card. No computer with aspirations to business use can now exist without provision for comms, and to rectify the omission is not simply a matter of plugging a card into one of the vacant slots. A software patch will also be required to make the system function correctly.

There is provision for connecting a cassette recorder, though this is a feature which is unlikely to be used: discs are much faster and more reliable. More useful is the games connector, which can be used to connect a bit pad or house a dongle for software protection. The socket is sensibly mounted at the rear of the case so that connections can be made from the outside without having to remove the lid.

The circuit board is of good quality, with all of the ICs in sockets for ease of



servicing. There is plenty of room for air circulation, so there should be no overheating difficulties even when the expansion sockets are fully populated. There are, however, several holes which are larger than the British Standard finger, so users with small children beware!

At the rear of the PCB there are two shrouded, polarised headers which accept the insulation displacement connector sockets for a standard Apple disc drive. I plugged in the Cumana drives I use with my Apple IIe. They worked first time and without any tweaking, which is not really surprising since the Unitron's disc interface is virtually identical to the Apple's.

The separate keyboard with an additional numeric keypad is a welcome departure from Apple practice. The feel of the keys is not as firm as those of the IIe, but proved quite acceptable. Layout of the keyboard follows that of the Apple II Plus. Normal display is 40-column, but with upper and lower case controlled by a Shift Lock toggle key.

The numeric keypad has four function keys: Home, ?, Delete and Return. There is no provision for an alternative character set but the motherboard has a connector for an 80-column card and one was supplied with the test machine. This card followed the soft-switching protocols used by the Videx and Vision 80 cards rather than those of the latest Apple cards. It was enabled automatically on booting a Microsoft CP/M disc.

Graphics

Hires and Lores graphics provide 280-by-192 and 48-by-40 pixel monochrome displays. The PCB had two jumper points marked "Pal", but I was unable to investigate whether it was possible to obtain a colour display since no UHF modulator is built in and I did not have a spare one to hand.

An autoboot EPROM is included so that languages can be loaded into the upper 16K of RAM in the manner of the Apple language card. As an alternative, the EPROM can be replaced with a small PCB which plugs into the D/L socket. This auxiliary card carries three 8K EPROM chips to provide floating-point Basic and integer Basic in firmware.

Integer Basic seems a curious choice, since it is no longer supported by Apple. It would have been more useful to use the 12K it occupies for the altered version of DOS 3.3 that many people load into the Apple language card, plus a few utility routines. A further anomaly is that switching between the two languages is achieved by a Call −1101 instead of the usual FP and Int commands. It would have required only a minimal alteration to the Basic code to make these commands operable. Both the Autostart and old monitor are available with their respective languages. The firmware old monitor is distinguished by a % prompt, although when it is loaded from disc into RAM it has the usual *.

To check the similarity of the two Unitron Basics to Applesoft and Integer Basic, I ran the Master Diagnostics test disc. Applesoft matched exactly, but Integer differed in the F0 ROM routines. This near identity was confirmed by a

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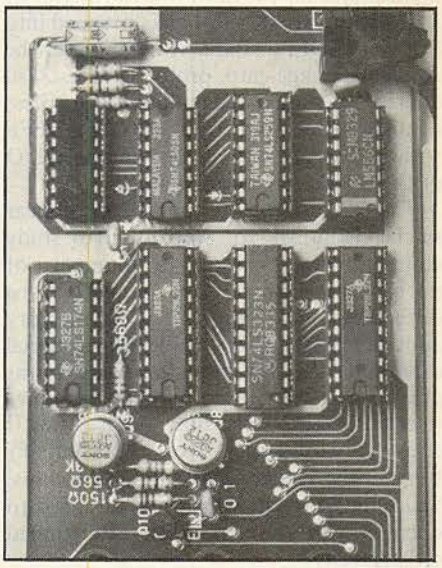
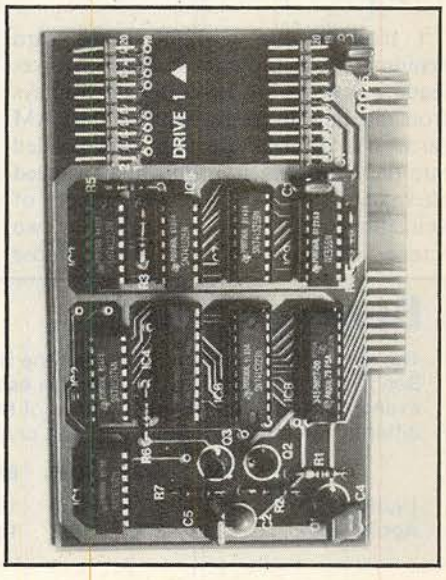




The disc-controller on the Unitron's board (above) and the Apple card (below)

(continued from previous page)
Monitor Verify command, comparing Unitron floating-point Basic and Applesoft loaded from the DOS 3.3 master disc.

The memory map of the Unitron follows established Apple practice. Pages 0 and 1 are used by the 6502 CPU for workspace and stack. Page 3 carries DOS vectors and has a small area available for user machine-language routines. Pages 4 to 7 and 8 to B are Text/Lores screen buffers while the Hires screens occupy pages 20 to 3F and 40 to 7F.

Memory map

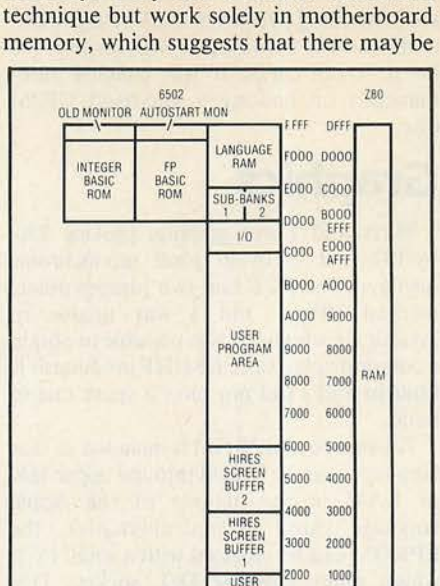
User program space runs from $C00 to $1FFF and $8000 to $BFFF. $C000 to $CFFF is memory-mapped I/O, soft switches and peripheral ROM and workspace. Soft switches are as listed in the Apple reference manual with the addition of Call −1101, which toggles between floating-point and integer Basic ROMs.

Three banks of memory are mapped into $D000 to $FFFF. Two are ROM based and carry the two Basics and the corresponding monitors, while the third consists of 16K of RAM with two 4K sub-banks mapped into $D000 to $DFFF. Bank switching uses the Apple language-card protocol. The Z-80 address lines are gated so that it can access contiguous memory from $0000 to $DFFF without conflict with memory-mapped I/O or the 6502's zero page or stack.

The expansion card connections appear to be identical to Apple's. To study compatibility I tested a number of peripherals which are sensitive to differences in timing signals or memory addressing. With an Apple Super Serial card and ASCII Express software I was able to transfer files to another computer over an RS-232 serial link. A Snapshot II copy card did not work, presumably because the Unitron has 64K RAM chips; Snapshot Copykit, which was designed to operate with the Apple IIe, functioned satisfactorily.

Apple software

I tried to run a 128K RAM card demonstration program which involves loading a series of Hires screen displays from disc into successive banks of the RAM card. The displays are then downloaded into the Hires screen buffers and switched alternately to give an appearance of animation. With this program, the two screen displays did not superimpose accurately, so the overall appearance was fuzzy. However, an arcade game and three-dimensional Supergraphics functioned correctly. They use a similar animation technique but work solely in motherboard memory, which suggests that there may be a problem in the downloading from the RAM card.



Z-80 address lines are gated to access memory from $0000 to $DFFF.

Specification

CPU: 6502 main processor with Z-80 second processor
Memory: 64K RAM, 24K ROM
Languages: Apple-compatible integer Basic and floating-point Basic in ROM
Operating system: CP/M, Apple DOS 3.3, Apple-compatible old monitor and Autostart monitor in ROM
Bus: Apple II compatible
Dimensions: 16.5in. wide by 11.5in. deep by 4.5in. high, ignoring keyboard
Keyboard: detached; Apple II Plus layout with separate numeric keypad and four function keys
Display: socket for video monitor; provision to connect UHF modulator; text display 40 columns by 25 lines, or 80 columns by 25 lines with plug-in card; Hires graphics 280 by 191 monochrome; Lores graphics 40 by 48 monochrome
Standard interfaces: Apple DOS 3.3-compatible disc interface
U.K. Price: £389
U.K. Supplier: Chiltern Electronics, High Street, Chalfont St. Giles, Buckinghamshire HP8 4QH. Telephone: (02407) 71234.

Benchmarks

The similarity of operation between the Unitron and the Apple IIe is shown by the Benchmark timings. The difference in each case is no greater than might be expected between different samples of the same computer, and can be attributed to differences in the controlling quartz crystal.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Unitron 2200	12.7	8.7	16.2	18.0	19.8	29.1	45.4	104.6	31.8
Apple IIe	12.7	8.7	16.2	18.0	19.8	29.3	45.7	105.3	32.0

The Unitron 2200 comes with a scanty 32-page manual containing the barest minimum of information required to get the system going. You are clearly expected to have a knowledge of Apple procedures; indeed, the most helpful part of the manual is the appendix which lists the Apple and Microsoft manuals containing the instructions necessary to operate the computer satisfactorily.

Crude changes

The text of the manual appears to have been produced with a dot-matrix printer, but many of the figures and tables are typeset and bear a remarkable resemblance to figures and tables from the Apple II reference manual, Apple product number A2L0001a. Some of the diagrams have been crudely amended in places — generally where there are differences between the Unitron and the Apple II.

With CP/M, the user is instructed to switch on, insert a CP/M disc and press a key to boot the system. No guidance is given on how to get Apple DOS up and running but, since the first boot routines on an Apple CP/M disc are identical with those on an Apple DOS 3.3 disc, the obvious thing is to try a similar procedure. Not surprisingly, it works.

A similar technique can be employed with VisiCalc, Pascal and other software which has its own variant of the operating system. I tried out several, including Merlin Assembler, Universal Boot Initializer, Fastdos and Nibbles Away II — all without any problems. They appeared to function in the usual manner. Software which can make use of additional memory boots normally and enables the additional RAM automatically; VisiCalc showed the expected 34K free.

Conclusions

● In terms of performance, there is little to choose between the Unitron 2200 and the Apple IIe, and only a minute proportion of Apple software is likely to fail to run on the Unitron.

● The Unitron is considerably cheaper, at £389, compared with around £933 at current discount prices for an Apple IIe with disc interface, numeric keypad, 80-column card and Z-80 second-processor card.

● As the model is newly introduced there are no indications of its long-term reliability. However, the standard of construction is high and the board should prove easy to service since the integrated circuits are socketed. Standard Apple diagnostic software can be used for testing and fault finding.

● The novice user would not be able to obtain sufficient information from the data provided with the Unitron and would need to purchase a set of Apple manuals to find out how to operate the computer.

A SELECTION FROM OUR PRODUCT RANGE

		CP/M	CP/M-86	MS-DOS	PCDOS
High Level Languages					
A	Supersoft	●			
SIC INTERPRETER	Microsoft	●		●	●
SIC COMPILER	Supersoft		●	●	●
SIC COMPILER V5.3	Microsoft	●		●	
SINESS BASIC COMPUTER	Microsoft			●	●
COMPILER	Microsoft			●	●
COMPILER	Supersoft	●	●	●	●
ASIC	Digital Research	●	●		●
ASIC COMPILER	Digital Research	●	●		
COBOL	Micro Focus	●	●		
BOL COMPILER	Microsoft	●		●	●
RAL-66	Micro Focus	●			
RTH	Supersoft	●			
RTRAN	Supersoft	●	●	●	●
RTRAN COMPILER	Microsoft	●		●	●
VEL-2 COBOL	Micro Focus	●	●	●	●
P	Supersoft	●			
LISP	Microsoft	●			
MATH/muSIMP	Microsoft	●			
SCAL COMPILER	Microsoft			●	●
SCAL MT+	Digital Research	●	●		
1	Digital Research	●	●		
Low Level Languages					
CRO-80	Microsoft	●			
GRAMMERS UTILS (RASM)	Digital Research	●	●		
Program Development Tools					
MATOR	Micro Focus	●	●		
	Phoenix Software Associates	●			
PLAY MANAGER	Digital Research	●	●		
UMB	Micrology	●			
EL II ANIMATOR	Micro Focus	●	●	●	●
VELOP	Phoenix Software Associates	●			
NK	Phoenix Software Associates	●			
NK II	Phoenix Software Associates	●			
NK-86	Phoenix Software Associates		●	●	●
	Digital Research	●			
ED PROGRAMMING PACKAGE	Digital Research	●	●		
-86	Digital Research	●			
	Digital Research	●			
Utilities/System Tools					
P	Keele Codes	●	●	●	●
SPOOL	Digital Research	●			
GNOSTICS II	Supersoft	●	●		
K DOCTOR	Supersoft	●	●		
KED-2	Slogger Software	●			
K-EDIT	Supersoft	●	●	●	●
KMAN	Slogger Software	●			
KORG	Slogger Software	●			
KTOOLS-1 (DISKMAN & DISKORG)	Slogger Software	●			
KTOOLS-2 (DISKTOOLS-1 & DISKED-2)	Slogger Software	●			
TIL (FOR DBASE-II)	Fox & Geller	●			
ESHARE	Micro Focus	●	●		
Rainbow (1) Format/Verify SVC	Silicon Valley Corp.		●		
Rainbow (2) Autorun Service	Silicon Valley Corp.		●		
Rainbow (3) Function Key Service	Silicon Valley Corp.		●		
Rainbow SVC S/W Vol 1 (1+2+3)	Silicon Valley Corp.		●		
TEM CHECKER	Supersoft	●			
OPERATING GUIDE	Decision Systems	●			
LITIES I	Supersoft	●			
LITIES II	Supersoft	●			
Sorting					
ORT	Microsoft	●		●	●
PERSORT	Micropro	●	●	●	●
Code Generators					
OCODE	Stemmos	●		●	●
MS-2	Micro Focus	●	●	●	●
CKCODE	Fox & Geller	●		●	●
LAST ONE	D.J. 'A1' Systems	●	●	●	●
LAST ONE—COMPACT	D.J. 'A1' Systems	●	●	●	●
Telecommunications/Conversions					
DEBIT	Comley Computer Services	●			
SCOPY	Comley Computer Services	●			
AM	Byrom Software	●	●	●	●
MS	Byrom Software	●			

		CP/M	CP/M-86	MS-DOS	PCDOS
Telecommunications (Cont.)					
ICL CO3 EMULATION (Bulk)	Synchro Systems	●			
ICL CO3 EMULATION (Interactive)	Synchro Systems	●			
ICL CO3 EMULATION (Interactive & Bulk)	Synchro Systems	●			
REFORMATTER CP/M ↔ DEC	Microtech Exports	●			
REFORMATTER CP/M ↔ IBM	Microtech Exports	●		●	
Word Processing/Text Editing/Editors					
CORRECTOR	Supersoft	●			
EDIT-80 V2.02	Microsoft	●			
LEXICON (WORD ANALYSIS)	Microtek	●			
MAILMERGE	Micropro	●	●	●	●
MEMOPLAN	Chang Labs	●	●		●
WORD	Microsoft				●
WORD WITH MOUSE	Microsoft				●
PARAGRAB	Focus	●		●	
PEDIT	Phoenix Software Associates	●			
PMATE	Phoenix Software Associates	●			
SPELLSTAR	Micropro	●	●	●	●
STARBURST	Micropro International				●
STARINDEX	Micropro	●	●	●	●
WORDMASTER	Micropro	●	●		
WORDSTAR	Micropro	●	●	●	●
WORDSTAR PROFESSIONAL (WS+MM+SS+STAR INDEX)	Micropro	●	●	●	●
Databases/Data Management Systems					
CONVERT	Southdata	●			
DATASTAR	Micropro	●	●	●	●
dBASE-II	Ashton Tate	●	●	●	●
INFOSTAR	Micropro	●	●	●	●
MAILING LIST	Southdata	●			
REPORTSTAR	Micropro International	●	●	●	●
SUPERFILE (SINGLE-USER)	Southdata	●			
SUPERFILE (MULTI-USER)	Southdata	●			
Financial Accounting					
INCOMPLETE RECORDS SYSTEM	MPI	●	●	●	●
NOMINAL LEDGER	Padmede Computer Services	●		●	●
OPEN ITEM PURCHASE LEDGER	Padmede Computer Services	●		●	●
OPEN ITEM SALES LEDGER	Padmede Computer Services	●		●	●
PADMEDE BUSINESS CONTROL SYSTEM	Padmede Computer Services	●		●	●
PAYROLL	MPI	●			
PURCHASE LEDGER	Padmede Computer Services	●		●	●
SALES INVOICING	Padmede Computer Services	●		●	●
SALES LEDGER	Padmede Computer Services	●		●	●
TIME & COST RECORDING	Padmede Computer Services	●		●	●
Financial Modelling/Problem Solving					
CALCSTAR	Micropro	●		●	●
DECISION ANALYST	Executive Software	●	●	●	●
LINEAR & GOAL PROGRAMMING	Electronic Accounting Services	●			
MATHSPACK	MPI	●		●	●
MICROPLAN	Chang Labs	●	●		●
MULTIPLAN	Microsoft	●		●	●
PLANTRAC 1	Computerline	●		●	●
PLANTRAC 1+	Computerline	●		●	●
PROFIT PLAN	Chang Labs	●	●		●
QSTAT	Pivotal Software	●			
STATSPACK	MPI	●		●	●
TK! SOLVER	Software Arts				●
TK! SOLVER PACKS					
FINANCIAL MANAGEMENT					●
MECH ENGINEERING					●
Business Applications					
JOB COSTING	Heseltine	●	●	●	●
POLICY MASTER	CSA Micro Systems	●	●	●	●
PRINT ESTIMATION	Software Mgmt Systems	●		●	●
STOCK CONTROL	Padmede Computer Services	●		●	●
Training Aids					
CP/M TUTOR	Syntax Software	●			
KEYBOARD MASTER	Anthony Ashpitel	●	●		●
TYPING MASTER	Anthony Ashpitel	●	●		●
Graphics					
dGRAPH	Fox & Geller	●			●
STATSGRAPH	Supersoft	●			

Free Catalogue Available

***Retailer and OEM Terms Available**

FORMATS

A1 - 8" SINGLE SIDED SINGLE DENSITY

APPLE CP/M-80 13 Sector	RG
APPLE CP/M-80 16 Sector	RR
AVL Eagle 1600	C1
Blackhawk Micropolis Mod II	Q2
British Micros Mimi	RF
CDS Versatile 4	Q2
Comart Communicator CP50	P2
Comart Communicator CP100	P2
Comart Communicator CP200	P2
Comart Communicator CP500	P2
Compal-80	Q2
Compustar	RK
Cromemco System 2 SS SD	R6
CSSN Backup	T1
Dec Rainbow	N6
Dec VT 180	RV
Direct 48TPI DS DD	R2
DRS 8801 CP/M-86 DS DD	RD
Exidy Sorcerer - CP/M-80	Q2
Facit 96TPI SS DD	N5
Future 32:16	C4
Gemini Galaxy DSDD 96TPI	NC
Hitachi 16000	C2
Hyperion Dynalogic	C1
IBM PC-DOS SS DD	C1
IBM PC-DOS DS DD	C2
IBM CP/M-86 SS DD	C3
IBM CP/M-86 DS DD	C4
ICL-PC	RE
Industrial Microsystems 5000 48TPI	RA
Intertec Superbrain SS DD	RK
Intertec Superbrain QD	RS
ITT Professional	C2
ITT 3030 (96TPI)	NA
Lanier EZ-1	C3
Micropolis Mod II	Q2
Miracle	N9
Morrow Designs Micro Decision	S5
Morrow Designs Micro Decision	RP
Multi-Tech 1	Q2
Multi-Tech 2	Q2
Nascom (Gemini Drives SS SD)	R3
Nascom (Gemini Drives DS SD)	R7
Nascom/Lucas	N1
NCR/M5DS	RB
NEC A.P.C. 8" DSDD	A2
NEC PC8001 SSDD	R5
NEC PC-8801 5" DS DD	RJ
NEC PC-8801 8" DS DD	A3
North Star Advantage	P2
North Star Horizon SS SD	P1
North Star Horizon SS DD	P2
North Star Horizon QD(Other CP/M)	P2
Nylac Micropolis Mod II	Q2
Olivetti M20 CP/M-86	C3
Orion CP/M-86 SS DD	N7
Orion CP/M-86 DS DD	N8
Osborne-I SS SD	RP
Osborne I SS DD	RC
Rade 1000 SS DD	RL
Rade 1000 DS DD	RM
Rair Black Box	RE
Research Machines 5.25in	RN
Robotron S	N3
Sanyo 2000 SS DD 96TPI	NB
SD Systems 5.25in	R3
Sharp MZ-80B	R9
Sharp MZ-3500	R9
Sharp PC-3201	R8
Sirius I (CP/M-86)	D1
Sirius I (MS-DOS)	D2
Shelton Signet	RK
Televideo DS DD	S5
Texas Instruments Professional	C2
Tiger 96TPI SS SD	N4
Torch	N2
Toshiba T200 DS DD	SF
Tycom Microframe	C2
Vector MZ	Q2
Vector Systems B	Q2
Vector VIP	Q2
Videocom Apollo	RQ
Wordplex	R4
Xerox 820 5.25in	S6
Zenith Z-100 Under ZDOS	C1

ORDER INFORMATION

When ordering software please specify the format you require. All software items are subject to VAT. Manuals, when purchased separately, are not subject to VAT. Please add £3.75 (plus VAT) for postage and packing for the first item purchased, and then £2.00 for each extra item. For overseas please add £6.50 for the first item and then £2.15 for each extra item required. Most software in this advertisement is available from stock. These details are current as of January 1984 (Telephone at time of purchase to confirm latest prices.) All payments must be in Sterling and drawn against a U.K. bank. Prices may change without notice due to fluctuations in the dollar exchange rate. Please confirm price at time of ordering.

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RML 480Z

Ian Stobie assesses Research Machines' 480Z and discovers it to be a bargain buy for the school desk top.

YOU ARE UNLIKELY to come across Research Machines' Link 480Z outside a school or college, although there is no reason why this eight-bit CP/M machine could not be used in an office or factory. However, from the earliest days of the microcomputer Research Machines Limited has specialised in selling into the educational sector, and this experience is reflected in the design of the 480Z and in the considerable body of software available for it.

The complete system under review here would cost the typical education user about £2,100, which includes dual floppy-disc drives, a Microvitec 14in. high-resolution colour monitor and an Epson RX-80 dot-matrix printer. The RML components of the system comprise the main unit, which in our case is the more expensive model L4 with colour graphics capacity, and the twin floppy-disc drive unit. The lowest priced 480Z system would cost £483 for the monochrome model L2 main unit. Both models come equipped with cassette and TV interfaces. RML operates a dual-pricing policy. Educational users pay about 20 percent below list prices on average size orders and it is these discount prices which are quoted here.

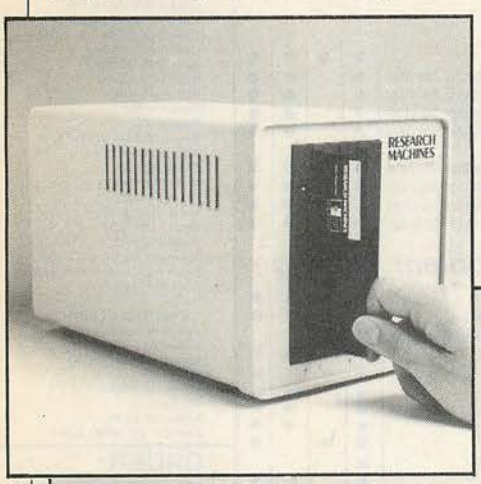
The 480Z was introduced at the end of 1981, intended primarily as a station on the company's Chain local area network. But the cassette-based 480Z configuration rapidly evolved into a stand-alone CP/M system with the expansion of memory to 64K and the addition of discs. Recently the 480Z has been through a restyling exercise, with a new layout of the main circuit board reducing the component count and a plastic, structural-foam case replacing the original metal one.

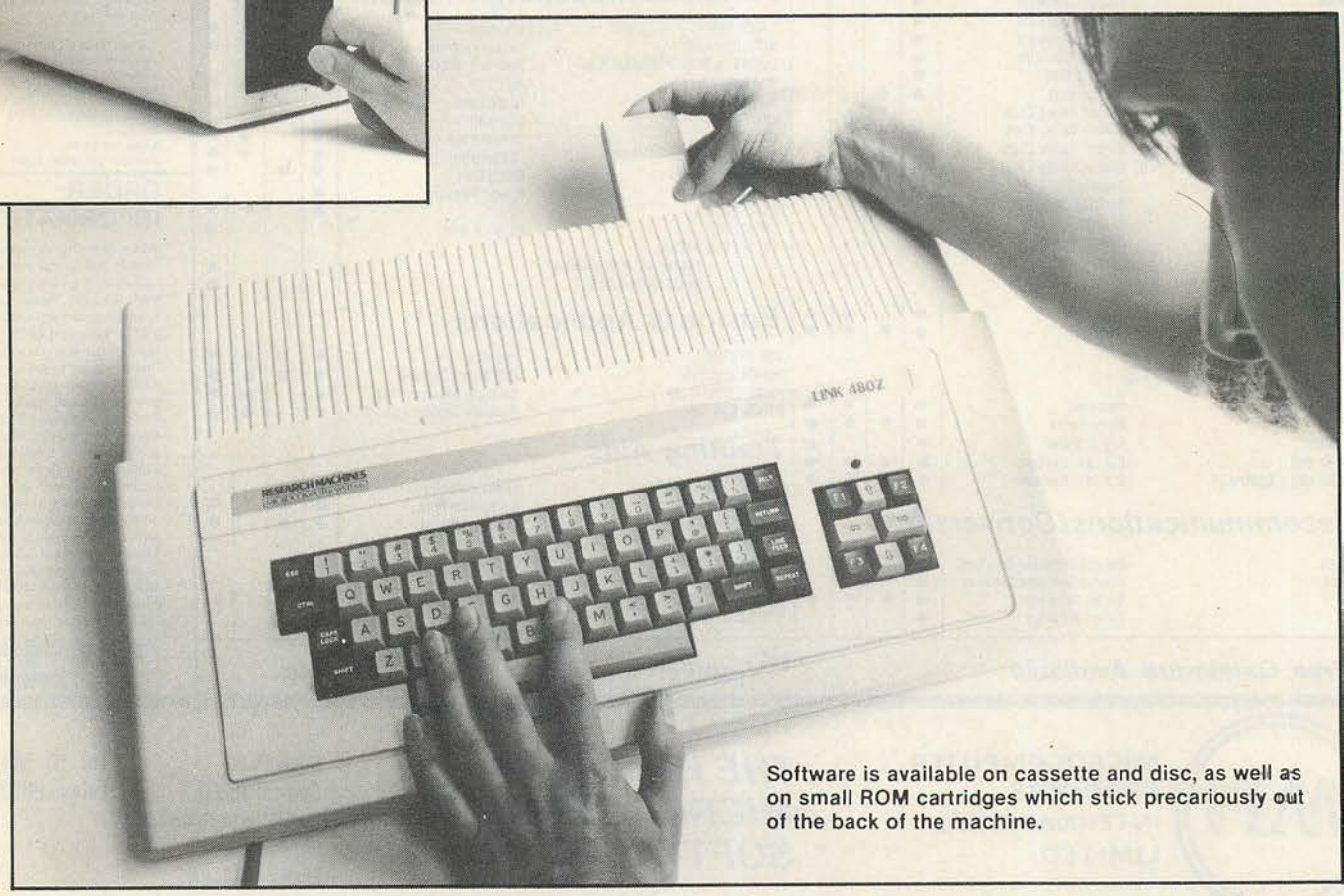
The cream-coloured foam casing of the main unit appears to be very strong, and there are no gaps to allow access for probing small fingers. It is larger than a BBC Micro, and takes up a space 21in. wide by 13in. deep. Moreover, the main unit is the wrong shape for you to place the Microvitec monitor on top of it, so both units take up their full measure of space on the desk top. The separate disc-drive box is also very bulky, so the system really requires a table of its own.

The 480Z keyboard has the normal QWERTY typewriter layout. The cursor keys are sensibly laid out to form a diamond pattern in a separate block together with four programmable function keys. All the keys are well constructed and have a good feel and generate upper- and lower-case characters, so the system is suitable for word processing.

Inside the main unit is the Z-80A processor and a standard 64K of RAM, expandable to 256K. On opening up the casing the impression is of a well put together system. Unusually for this size of machine, there is a cooling fan, which should enhance reliability.

The two floppy-disc drives are in a box weighing 15lb. Each drive provides a formatted capacity of 328K, recording on both sides of a standard 5.25in. disc. A single drive unit is available for about £500.





Software is available on cassette and disc, as well as on small ROM cartridges which stick precariously out of the back of the machine.

Connecting up the system is simple, although the discs, monitor, main unit and printer have mains leads of their own, adding to the untidy impression given by the system. This is unlikely to be regarded as an important point by schools, but a rethink would be necessary if RML ever wanted to sell a version of the machine into the office market.

When you turn the machine on and insert a disc in the left-hand drive the system does not immediately boot up CP/M. Instead a large-character 40-column wide display comes up on the screen, inviting you to hit R to enter the RML Basic contained in ROM, or hit H for Help. This display is put out by the monitor program called ROS 1.2 also contained in the 28K of software in ROM, which functions as the cassette operating system.

Normally you would type in B to boot up CP/M from disc. The system then loads CP/M 2.2 in the normal way, with the screen automatically resetting to 80 columns wide. The disc drives themselves are quiet except when accessing, when they clatter loudly. The fan in the 480Z main unit runs too quietly to be noticed.

Our system came fitted with the full 256K of RAM so we could try out a silicon disc feature which RML plans to offer soon as an option. At the time of writing price details are not available. What you will get when the system is released, apart from the additional 192K of RAM, is a disc with a modified version of CP/M 2.2 on it. You switch on and boot up from the ROS display in the normal way, then run a utility called Mdisc to format the extra RAM area so that it emulates a disc; 174K of the RAM is available for use. You then copy the files you want to use across from a floppy to the disc emulated in RAM. The RAM disc is known as M: to CP/M so you can use Pip. For instance

PIP M:=B:*.*

copies the files across from drive B.

The aim of the exercise is to speed up programs which will access the disc frequently. Running WordStar off M: accelerated things appreciably with negligible disc delay when pulling up menus or printing from the last few pages of a document. If you reset while running off M: the contents are still there, but if you switch off the 480Z you lose the contents of the RAM. So it is important with any silicon-disc system to remember to copy your files back to a real floppy disc at the end of a session.

ROM packs

ROM packs are another recent development for the 480Z. They plug into the parallel port at the back of the machine and are available in 16K or 64K versions. As yet there is not much software available using the system but RML says there will be, with several educational software suppliers preparing programs. The packs contain common types of EPROM so costs will probably be low enough for small-volume software producers like local education authorities to release programs on ROM.

We were supplied with a ROM pack which had some Basic demo programs on it. You plug in the ROM pack, and press Reset. The RML system appears to copy the ROM contents into RAM before the program is run. This takes a few seconds, but compared to using a cassette it is convenient. Most ROM packs on other machines switch out part of the existing memory and are then directly addressed by the processor. The only weakness to the RML system is the ROM pack design, which looks vulnerable. It sticks out the back of the machine, held only by the pins of the parallel-port connector. The likely price of ROM packs from volume producers is about £88.

The 480Z was originally developed as the disc-less work station for the Chain network. Up to 16 disc-less 480Zs can be attached to the network via a central network controller based around a modified version of RML's larger 380Z computer. The 380Z has extra boards added and its screen and keyboard removed to fulfil its role as network controller. A floppy or Winchester hard-disc unit and printer are typically attached to it. A single coaxial cable runs between all the 480Zs and the network controller so the wiring is not messy.

All the 480Zs can then use the discs and printer, with the network controller sorting out any clashes and, for example, temporarily storing output destined for the printer until the device is free. An individual 480Z user can link into the network by switching on their machine and choosing the N option from the initial Help display put up by ROS.

Regrettably, I did not have a Chain network to play with but the obvious advantage is cost. A typical educational price for a twin-drive network server is £1,734, with a printer at £333, so for just

(continued on next page)

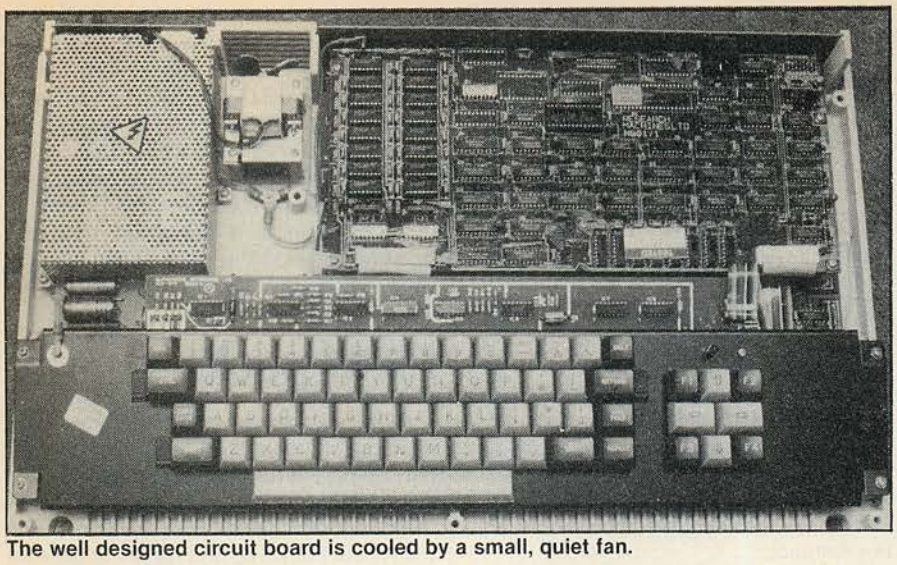
Benchmarks

The table shows the time in seconds to run eight standard Basic routines. The Benchmark routines test out various typical tasks, each repeating an appropriate set of Basic statements 1,000 times. The Basic interpreter used was RML Extended Basic in ROM version 5.48, as supplied with the 480Z.

Machine and CPU	1	2	3	4	5	6	7	8	Av.
BBC Model B—6502	1.0	3.1	8.3	8.7	9.2	13.9	21.9	52.0	14.8
IBM PC—8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30.0	16.8
RML 480Z—Z-80A	1.1	6.9	13.5	13.0	15.0	23.2	33.1	50.7	19.6
Spectrum—Z-80A	4.8	8.7	21.1	20.4	24.0	55.3	80.7	253.0	58.5
Apple IIe—6502	12.7	8.7	16.2	18.0	19.8	29.3	45.7	105.3	32.0

Specification

CPU: Z-80A running at 4MHz
RAM: 64K, expandable to 256K
ROM: 28K, containing 20K Basic and monitor
Display: sockets for external black and white TV and monitor outputs are standard on model L2 with colour option available on model L4; shows 24 lines by 40 columns or 24 lines by 80 columns and 160-by-72 dot medium-resolution graphics in two grey tones; model L4 adds TTL RGB colour output and three graphics modes including 640-by-192 dot monochrome and 160 by 96 dots in eight colours
Keyboard: QWERTY-layout keyboard forms part of main unit, with separate cursor and control-key block, generating upper- and lower-case characters; 65 keys in total
Interfaces: one eight-bit parallel port; two RS-232 serial ports, one low-speed suitable for printer, the other high-speed for communications or disc; cassette interface, one joystick port; network interface comes as standard, allowing the 480Z to become a station on RML's Chain LAN
Dimensions: main unit's footprint on desk is 21in. by 13in.
Discs: twin 5.25in. floppy drives in separate unit, double sided, each drive with formatted capacity of 328K; disc unit weighs 15lb.; single-drive option also available; on 480Z systems fitted with 256K of RAM most of it can be configured as a silicon disc
U.K. price: RML quotes a typical education price about 19 percent lower than the list price which allows for 10 percent educational discount and 25-plus volume order; typical educational price for the complete system reviewed here comes to just over £2,100, with 480Z model L4 with high-resolution graphics at £585, twin 5.25in. floppy drive at £748, 14in. Microvitec high-resolution colour monitor at £450, and Epson RX-80 printer at £333; typical education price of monochrome 480Z model L2 is £483, single 5.25in. floppy drive, £499; model L2 can be upgraded to model L4
Software: RML has its own operating systems and versions of Basic but CP/M 2.2 comes with disc system; a wide variety of software is available on cassette and disc, with some programs available on 16K or 64K ROM packs which plug into the parallel port; RML is offering low-price disc software bundles
Manufacturer: Research Machines Ltd, made in U.K.
U.K. distributor: Research Machines Ltd, PO Box 75, Mill Street, Botley Road, Oxford OX2 0BW. Telephone: (0865) 249866



The well designed circuit board is cooled by a small, quiet fan.

(continued from previous page)
over £2,000 you can add disc and printer facilities to up to 16 480Zs.

RML is also experimenting with a more limited but cheaper system which works along similar lines. The shared-disc system is scheduled for release in early 1984 and will allow up to four 480Zs to share a disc drive.

Ever evolving

The 480Z is a continuously evolving system. This is praiseworthy, but does have some drawbacks. For example, RML is for ever releasing new versions of its Basic and upgrades to operating system ROMs, and although the software packages generally come with a piece of paper in the manual telling you what set-up they will run on, at first all the version numbers can look very confusing.

Documentation takes the form of a mass of separate manuals on Basic, the cassette system, the disc system and on any other products you have opted for, like Logo or WordStar. All the information is there, but dedication and a serious turn of mind are assumed. This uncontrolled approach can be contrasted to that now adopted by Apple: you can obtain various reference manuals if you want them but the standard documentation set is carefully restricted to easy-to-understand manuals which are often accompanied by tutorial material on disc.

As a CP/M machine the 480Z can run general business software packages like WordStar and Multiplan. RML is offering mixed bundles of educational and general business packages to schools and colleges at very low prices. The packages are well chosen and enhance the attractions of the 480Z to qualifying purchasers. Logo, Touch'N'Go, Word and Quest cost £39, Pascal, Assembler, Telesoftware, Sir and Text Editor cost £95; these prices apply to any RML user. Schools using the 480Z attached to a Chain network will receive these together with Basic and WordStar for nothing. For £395 educational users of Chain can have the same package plus Cobol, Fortran and Multiplan.

RML does not face any direct competition. Although the BBC Micro, the Apple II, the Commodore Pet and the Sinclair Spectrum are popular in schools and colleges, they all plug into different software bases.

The Apple comes nearest to the RML machines as it can be enhanced cheaply to run CP/M programs. Apple and Commodore are American companies so American-written educational software is available to supplement that which is produced locally — which may be an advantage. Probably the only machine which rivals the strength of RML in offering software tied closely to U.K. curricula is Acorn's BBC Micro. However, the best recommendation to any potential purchaser is to look at the software first and let the availability of what you want determine your choice of machine.

Conclusions

- **Beautifully built, the 480Z cannot be faulted for the quality of construction of the hardware.**
- **Although very robust, the system takes up an unnecessarily large amount of space.**
- **The 480Z is conservative in specification terms — after all it is an eight-bit CP/M machine like countless others built over the last nine years. This is not necessarily a bad thing for educational users, since educational software, especially packages properly integrated with other course material, takes a long time to develop so it is not likely to be available for the latest machines or operating systems.**
- **The 480Z is amply provided with educational software. The eight-bit CP/M used on the 480Z also offers the advantage of a vast range of business software at a low price.**
- **RML's special software deals for schools and colleges are good value. The packages are well chosen and show the company's attention to understanding the needs of educational users.**

RML

Questions

1. Which of these is **not** a programming language?
A. Dibol B. Snobol
C. Cobol D Lisp
E. Gargol

2. Which of these is not a **high-level** programming language?
A. Pascal B. Basic
C. Assembler D. Fortran
E. Cobol

3. When did high-level programming languages first come into use?
A. 1940s B. 1950s
C. 1960s D. 1970s
E. 1980s

4. Which of these languages was the first to be implemented?
A. Pascal B. Fortran
C. Basic D. Cobol
E. Logo

5. Which of these languages was first developed by Professors Kemeny and Kurtz?
A. Pascal B. Modula-2
C. BCPL D. Basic
E. Smalltalk

6. Which of these languages was originally developed to control radio-telescopes?
A. Logo B. Forth
C. Fortran D. Lisp
E. Occam

7. Which of these languages was designed for children to use, and embodied for the first time the idea of turtle graphics?
A. Logo B. Lisp
C. C D. Forth
E. Pilot

8. Which of these languages was designed with the intention of inculcating good structured programming habits among students?
A. Basic B. Fortran
C. Assembler D. C
E. Pascal

9. Which of these languages was developed in Britain?
A. Ada B. Pascal
C. BCPL D. Fortran
E. C

10. Which of the following figures is closest to the percentage of British secondary schools that use Research Machines 380Z or 480Z computers?
A. 5% B. 10%
C. 20% D. 40%
E. 80%

COMPETITION

Win a complete 480Z system in our great Languages Competition.

THOUGH DESIGNED especially for educational use, the 480Z is also suitable for general business applications as it is a solidly built CP/M machine. The prize system, generously provided by Research Machines Ltd, is based on the model L4 version with high-resolution colour graphics, so it would also make a luxurious home system. Also included are a high-resolution Microvitec colour monitor, a RML dual-floppy disc drive, an Epson RX-80 dot-matrix printer and all the software packages provided under the RML school and college network scheme.

The competition is open to all individual U.K. readers of *Practical Computing*; however, we will accept one entry per person so schools and colleges have a certain advantage if they care to photocopy the entry form.

The winning entry will be the one which in the judge's opinion answers the questions correctly and provides the most original and witty suggestions to the tie-breaker problems. Each question only has one correct answer. Write down the letter corresponding to the correct answer to each question in the boxes on the entry form. Then do the tie-breakers.

Rules

1. The competition is open to all readers of *Practical Computing* normally resident in the U.K., except for employees of Business Press International Ltd or Research Machines Ltd, or their families.
2. Each entry must be written in ink on the official entry form printed here or on a clear photocopy. Only one entry per person is permitted.
3. Completed entry forms should be posted to the address shown on the entry form to arrive not later than April 30, 1984. Envelopes must be clearly marked "COMPETITION" in the top left corner.
4. The Editor of *Practical Computing* is the sole judge of the competition. No correspondence can be entered into regarding the result of the competition and it is a condition of entry that the judge's decision is final.
5. The winner will be notified by post and the result of the competition announced in the first available issue of *Practical Computing*. The winning entry will be reproduced, and other entries may be reproduced without payment.
6. The prize is a RML 480Z system with monitor, discs, printer and software. No cash substitute will be offered.
7. The prize will be awarded to the individual named on the winning entry form, unless the contestant names a U.K. educational institution they would like the prize to go to instead, in which case the prize will go to the institution.

Entry form for *Practical Computing* 480Z Languages Competition

Name .....

Address .....

.....

.....

.....

If I win I want my prize awarded to .....

.....

.....

(write either "myself" or the name of a U.K. educational institution)

Signed .....

Answers

1. ☐	2. ☐	3. ☐	4. ☐	5. ☐
6. ☐	7. ☐	8. ☐	9. ☐	10. ☐

Tie-breakers

1. The name "Basic" is supposed to stand for Beginners' All-purpose Symbolic Instruction Code. Make up a name for a new language out of the initials of words explaining the special purpose of the language. The acronym does not have to be exact, but in any case limit yourself to under 12 words of explanation.

.....

.....

.....

2. *Practical Computing* is thinking of producing a tasteful sweatshirt; all we need is a suitable slogan. Suggest one of eight words or less.

First try .....

.....

.....

Second try .....

.....

.....

Return this entry form to: Practical Computing/ RML Competition, Room L306, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.
Write "COMPETITION" clearly on the top left-hand corner of the envelope.

SINCLAIR QL

Jack Schofield reports on the new Sinclair micro, which once again combines low price with an astonishingly ambitious spec.

EACH OF Sinclair's new machines has been more amazing that the one before, but this time he has really excelled himself. The QL fully deserves the initials, which stand for Quantum Leap, it is so far ahead of everything else at the same price.

The Sinclair QL is a 32:8-bit multi-tasking micro with windowing, 128K of RAM, two built-in Microdrives, a good-quality keyboard, a good selection of I/O ports and four software packages, all for £399.

The CPU is the Motorola 68008, the newest and most junior member of the powerful 68000 family. It has a 32-bit internal architecture and an eight-bit data bus. The 68000 itself is a 32:16-bit chip used in more expensive machines such as Apple's Lisa at £7,500, the Fortune 32:16, the Sage II, Wicat 150, Hewlett-Packard Model 16 and similar models at £3,500 upwards.

Perhaps the micro which is closest in terms of functionality would be a £2,000 IBM PC running the window manager Desq which costs $399 extra, not including the applications software. That, at least, was my impression at the launch of the QL, where all the demonstrations were run using real machines, said to be "pilot production models".

Obviously there will be teething problems — all new micros suffer from them. However, the QL is being made by Thorn-EMI at its Feltham plant which used to build the Newbrain, an earlier Sinclair design. On past performance, the QL should be well made but there will probably be supply problems due to demand.

There will also be bugs, and some features of the QL will turn out to have unforseen and possibly unwanted consequences. But even so, the Sinclair QL is too powerful a machine for anyone to ignore — and that includes professional and educational as well as home micro users.

The QL comes complete with 128K of RAM, of which 32K is dedicated to the screen display. That leaves 96K of user RAM, some 2½ times the amount free to Basic in a 64K Commodore or Atari. Sinclair says a half-megabyte RAM pack will be available later to fit the expansion bus. Let's hope it doesn't wobble.

Mbyte addressing

The QL has 32K of ROM, which contains both Sinclair SuperBasic and the QDOS multi-tasking operating system. A further 32K of ROM can be added via the cartridge slot in the back. This slot and its cartridges appear to be physically the same as the Spectrum ones, but are not compatible. Altogether this accounts for 704K, while the total linear addressing capability of the 68008 is 1Mbyte, from 00000 to FFFFF.

The QL has no cassette-tape port and no disc interface. Mass storage is provided by two built-in Sinclair QL Microdrives. Each contains a 200in. loop of video tape moving at 30in. per second, making a circuit every 7.5 seconds. This justifies Sinclair's claim of average access time around 3.5 seconds

Each Microdrive has a capacity of up to 255 sectors of 512 bytes. The capacity is quoted conservatively at 100K each — about 16K more than the Spectrum Microdrives. The two versions are not compatible, though both can use the same cartridges if they are appropriately formatted. Up to six extra QL Microdrives can be added, to provide 800K on-line storage, and a hard-disc interface has been promised for the future.

The Microdrives remain as yet unproven for serious use, so obviously many people will want to add conventional floppy-disc drives. This may be possible via the expansion bus, or the two RS-232C ports provided. The ports transmit at 75 baud to 19,200 baud, or provide full duplex transmit/receive at up to 9,600 baud.

The ROM-resident QDOS operating system was not demonstrated at the launch, but appears to be Unix-like. It seems most commands can be used from SuperBasic. The Exec command will load a sequence of programs and run them in parallel.

Sinclair SuperBasic is an enhanced

Mass storage is provided on 100K Microdrive floppy-tape cartridges.

ersion of Spectrum Basic — with some nassive improvements. The wretched nultiple-shift "single keyword" entry has, hankfully, gone. Other enhancements nake the language much more BBC-like. For example, SuperBasic has procedures, nd variables can be defined as Local. Structured commands include If-Then-Else, If-Endif, and Repeat-End Repeat.

Special commands to handle the vindowing capability include Window, vhich is used to create one, and Pan to llow sideways scrolling. Pan 50 means Pan eft by 50 pixels. To the Spectrum concepts f Paper and Ink you can now add Under, Over and Strip. Windows look like fun. There is also Date$ for the battery-backed eal-time clock, a nice feature sadly lacking rom the Acorn BBC machine and the IBM PC.

The QL can drive a colour TV or RGB nonitor directly. The screen display is bit napped with co-ordinate 0,0 in the top left. Screen RAM is organised as 16-bit words tarting at 20000 hex and progressing with he raster scan.

There are two display modes. The four olours black, red, white and green can be sed with 512-by-256 pixel definition. In he 256-by-256 pixel mode, eight colours re available: black, blue, red, magenta, reen, cyan, yellow and white.

The SuperBasic command CSize is used o set character size. Characters can be 6, 8, 2 or 16 pixels wide, and 10 or 20 pixels igh, opening up a wide range of effects. The character set can be redefined. On a nonitor the QL will normally display 85 olumns of text by 25 lines. On a TV set, the vidth may be from 40 to 60 columns.

There must be reservations until pro-uction samples become available, but the QL's 65-key keyboard seems excellent. With the legs supplied to lift the back it has good angle, and the full-travel keys seem ine for touch-typing. They are also leasantly quiet.

Key layout

The key layout is excellent, with a full pace bar, two Shift keys and an over-sized -shaped Return key in exactly the right lace. There are four cursor-control keys: ft and right arrows are to the left of the pace bar, up and down to the right. There re also five function keys, plus Control nd Alt.

Most of the key assignments seem orrect, though there are some oddities. or example, there is no Delete key: you use trl-Left Arrow instead, but at least they re close together. As on the Spectrum, oth £ and $ are present. Sinclair's rochure, attached to U.K. copies of this agazine, reproduces the keyboard full ze.

The QL is well supplied with ports, most f which have already been mentioned. The vo ports labelled CTL1 and CTL2 are for ne or two joysticks. Regrettably they will ot accept the standard nine-pin D Atari-pe connector used on the Spectrum interface. The same ports will undoubtedly run other accessories too. The QL has no parallel port, but a Centronics printer port is promised as an add-on extra.

The network ports are for QLAN, the QL's built-in local area network. It allows up to 64 QLs and Spectrums to be connected with a data-transmission rate of 100K baud. Has no one at Sinclair noticed that there already is an entirely different system called QLAN? It is produced by Quorum for the Canon AS-100 micro — see our November 1983 issue, page 113.

Four software packages are supplied with the QL: a word processor, a spreadsheet, a database and a business graphics package. Data can be passed between them using the Import and Export commands. All four programs have been wirtten by Psion, which will fully support and upgrade the software for people who join QLUB at a cost of £35 per year.

Extravagant claims have been made for these packages: "They outperform the software for all existing micros". On demonstration they looked fast, attractive and user-friendly — but then, it would be a poor demonstration if they did not. Judgement must be reserved until after we have had the chance to test them.

Specification

CPU: Motorola 68008 running at 7.5MHz; 32-bit internal bus, eight-bit data bus; 1 Mbyte linear addressing capability
Other ICs: Intel 8049 controller plus four semi-custom ULAs
Memory: 128K RAM, including 32K video RAM; 32K ROM; RAM expandable to 640K; ROM expandable to 64K via 32K cartridge slot
Keyboard: 65-key moving-key QWERTY layout with four cursor keys and five function keys
Storage: two built-in 100K Microdrive floppy tapes, average access time 3.5 seconds
Display: via additional TV or monitor; monitor display up to 85 characters by 25 lines; TV from 40 to 60 characters by 25 lines; user-defined character sets
Graphics modes: 512 by 256 pixels in four colours or 256 by 256 pixels in eight colours; colour coding is non-compatible between modes
Built-in software: Sinclair SuperBasic structured Basic with procedures, extendability and full-screen editor; QDOS multi-tasking operating system with time-slice job scheduler, multiple windowing and device independent I/O
Software in price: Quill word processor; Abacus spreadsheet; Archive database and Easel business-graphics package; all written by Psion
Interfaces: TV and RGB monitor ports, Microdrive expansion, two RS-232 serial ports, two joystick ports, two local area network ports, main-board expansion bus, internal expansion socket
Power supply: 9V DC at 1.8A; 15.6V AC at 0.2A
Dimensions: 138mm. by 46mm. by 472mm.
Weight: 1,388g (3 lb.)
Price: £399 including VAT, plus £7.95 post and packing
Availability: mail-order only, in limited quantities from the end of February

Competition

If the claims are true, the software alone must be worth somewhere between £400 and £1,500. But even if they are not the QL on its own looks worth rather more than the asking price so it's hard to see how you can lose on the deal.

At the moment, only one company has a comparable machine at under £5,000, including software. That is Apple, whose new Macintosh is also previewed in this issue.

Several other companies are rumoured to be working on 16/32-bit small micros. Commodore is said to be using the Z-8000, Atari and Apple the 68000, and IBM has an 8088 in the PCjr. Acorn is readying the ABM, a business micro using the National Semiconductor 16032 chip. But the Sinclair QL is almost here, and the rival machines are not. Sinclair will be selling the machine in the U.S. at $499.

It will be most interesting to see Acorn's response. The QL makes the Electron look feeble, and it offers so much for the money the BBC Model B itself could be threatened. A redesigned, cheaper main board looks overdue, as does a price cut.

Conclusions

● The Sinclair QL has an excellent specification, a good keyboard, a good range of ports and looks unbeatable value for money.

● Although it will be initially short of software, especially until everyone learns 68000 assembler, the packages included promise to make it a usable machine from the start.

● SuperBasic, the real keyboard and LAN make the QL a very attractive machine for schools, colleges and, especially, students of computing.

● When the hard-disc interface arrives, or someone hooks up a couple of standard twin floppies at, say, £400 the Sinclair QL has the potential to beat every business micro on the market at under £2,000 — and most that are under £5,000. If I ran ICL, I would launch just such a version, at £999, at the earliest possible moment.

● If the QL is reliable, delivered in quantity and lives up to its promise, it should do very well indeed, providing competition even for IBM.

● The Sinclair QL is designed by Sinclair Research of Cambridge. Enquiries can be sent to Sinclair at Freepost, Camberley, Surrey GU15 3BR. Telephone: (0276) 686100.

BY NOW, even the most Luddite of executives is probably convinced that the spreadsheet is a valuable tool. Apart from saving them and their accountants endless recalculations, managers can see what is happening in their business; at the flick of a switch the budgets and forecasts of a company are laid bare.

The strength and success of the spreadsheet lie in being able to provide a wide range of analyses. Because it provides a minimum of structure, it is almost endlessly flexible. But what is simple can often be too simplistic. Now that spreadsheets have come of age, there is a need for management tools based on related software techniques.

A step further

Integrated packages like Lotus 1-2-3 are a step in the right direction. By allowing sophisticated spreadsheet methods to be linked to graphics, direct, easy-to-understand representations of otherwise dull esoteric figures can be obtained, so that broader judgements are more likely to be made. A similar development can be found in Fox and Geller's dGraph, which produces graphics output from dBase II. Now Fox and Geller has gone one step further with Oz, a management-control system uniting spreadsheet-type features with extended graph options.

Oz runs on the IBM PC or XT with 256K of RAM and, it is claimed, on compatibles. The cost is £330. It is aimed specifically at companies and other similar organisations: standard management and financial structures of companies are built into Oz, but the greater depth of analysis is bought at the expense of versatility.

OZ

Glyn Moody examines a management-control system that aims to wave a magic wand over the mystique of company accounts.

When you boot the main program, which occupies a healthy 135K of RAM, the entry menu presents two classes of objects, namely Actions, which manipulate the data, and the data itself. The names Actual, Budget and Forecast represent three parallel sets of data. Budget and Forecast are entered at the beginning of a financial year, and Actual is entered as figures become available.

The figures entered are all quantities that must be defined beforehand as line items — see figure 4. They represent some of the basic variables of the situation. For example, it will be possible to single out Rev, the total sales, for detailed analysis and graphical representation. Entering Budget or Actual data consists of assigning some of these variables with, for example, budgeted or actual sales of product X or Y.

A further refinement is the breakdown of the company into a hierarchy of units. Thus a typical organisation Softco might be made up of three divisions: Admin, administration; Market, marketing; and Tech, technical. They might be broken down further with, say, Market comprising Adv, advertising, as well as Planning and Sales. The basic variables defined are entered only for these elementary units. It is possible to unite the various components using the Consolidate option of the main menu; figures are then available for elementary and consolidated divisions. All these actions may be performed separately on any of the basic data sets such as Budget, etc.

Figures analysis

Having set up the company structure and the data, it is now possible to begin analysing the figures. Again, analysis can be of any data set for any division of the company. For example, the budget figures for Sales might be chosen. This is done by entering the relevant name in the main menu. Movements within the menu are achieved by cursor controls or initial-letter commands — M for Modify and so on.

Each command is usually followed by a further menu, where movement is effected similarly. Movement back up to higher levels of the nested menus is done by means of the Esc key. This is fine except that one Esc too many and you are back in MS-DOS, with Oz and its input junked. Consistent commands for mobility are all very well, but a distinction should be made for the final exit.

Analysing the Actual figures for Softco produces figure 1. Here the Rev, Exp and net — which equals Rev – Net — are given for the year so far. Now Softco has three divisions, and by pressing the Oz-defined function key F8, you can obtain the same

Actual SOFTCO

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
REV	10	11	13	16	18	20	21	20	21	–	–	–	150
EXP	12	12	11	16	16	16	17	17	17	–	–	–	133
NET	-2	-1	2	–	2	4	4	3	4	–	–	–	17

Figure 1. Raw data for Softco.

Actual January

	SOFTCO	ADMIN	MARKET	TECH
TOTAL SALES	10	–	10	–
TOTAL EXPENS	12	4	4	4
NET INCOME	-2	-4	6	-4

Figure 2. The Cube provides a two-dimensional analysis of the data

Actual TOTAL EXPENSES

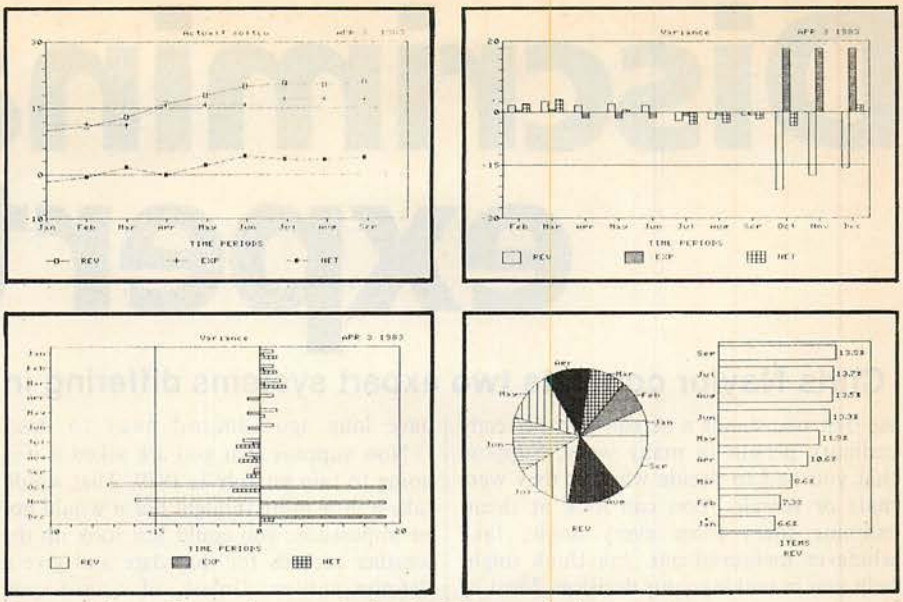
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SOFTCO	12	12	11	16	16	16	17	17	17	–	–	–	133
ADMIN	4	4	3	3	4	3	5	5	4	–	–	–	34
MARKET	4	4	4	7	7	7	8	8	8	–	–	–	59
TECH	4	4	4	5	5	5	5	5	5	–	–	–	40

Figure 3. An alternative analysis, by month and division.

figures for Admin, Market and Tech.

You can examine the analysed data in a different way. Hitherto the three elements Rev, Exp and Net have been considered for 12 months, for Softco, for Market and so on. But you could consider these three things for Softco and its three divisions, simultaneously for one particular month. This is effected by using the key F6 — the Cube as Fox and Geller terms it. Figure 2 shows the result.

The name Cube arises from the fact that there are three sets of variables: you have a choice of divisions, a choice of financial breakdown and a choice of month. These three sets can be thought of as lying along three edges of a cube which meet at a corner. Each of the previous possible analyses is like slicing through the cube to give a two-dimensional table which is printed out as in figure 2. Moving the slice along corresponds to producing successive tables for January, February, and so on.



A range of graphing options can be invoked from a single menu.

Cube cutting

There remains a third way of cutting the cube. It is shown in figure 3, where the Total Expenses are broken down by month and division.

Two simpler facilities should also be mentioned. By pressing Q, the totals are converted from monthly to quarterly ones; pressing Q again converts them back. Pressing the minus sign enables negative quantities to be highlighted. At this point Oz makes striking use of its colour facilities. Hitherto, the entries have been against a blue background but pressing – sends shocks of bright red throughout the sheet, illustrating where deficits occur.

Colour is also important in a further facility sinisterly called the Midas Touch, and instigated by function keys F2 and F7. This highlights in garish yellow selected entries of the analyses obtained. It allows for the chosen entries to be "exploded" to find out what the constituent parts of that entry are by using another function key, this time F4. For example, the Actual figures for Market can be exploded to reveal the contributions from product X, product Y and Oz. Since this exploding facility can be combined with the Cube option, and for any of the data sets, it can be seen that Oz's manipulative power is extraordinary, if dizzying in its complexity.

Happily, salvation is at hand in the graphics options. At any point during the generation of figures a last function key can be invoked: F4, the graph key. From an on-screen menu it is possible to produce instantly bar, pie, line, area, percentage bar, stacked bar and horizontal bar graphs. The colour graphics are superb and generally very fast; only the pie charts falter slightly.

One other facility provided by Oz is a variance analysis report. A Budget variance, for example, produces Actual versus Budget comparisons by month, quarter and year. This is a standard but useful procedure.

Powerful tool

Within its limitations, Oz provides a very powerful tool for analysing and displaying company and organisational information. It is, however, strongly geared to its archetype of a company with several divisions, manufacturing several products. Firms offering services will probably find it less flexible. It must also be remembered that Oz cannot produce anything that was not originally fed in. It merely allows end effects to be chased and finally compared to initial inputs. One useful facility here is the option of adding a reason for an input figure — why it has been entered or changed. This comment is stored as the lowest level of the information's nested tree structure.

Refinements that might be contemplated include simplification of the Midas Touch and, to a lesser extent, the Cube. Since an obvious method of filling in the figures would be to have each division input them directly, it would be sensible to add a hierarchical password structure. Also it would be useful to have an integral linked spreadsheet. It would allow managers to try out budgets and forecasts for their divisions before transferring across to the main body of the program. The maker claims that Oz can read data from VisiCalc and SuperCalc.

The version reviewed here was a demonstration one only. A number of further facilities such as a Help option are promised.

LINE ITEMS

Ln#	Tag	Description	Cat	Computation
1	BDX	Brand X Product	R	
2	BDY	Brand Y Product	R	
3	OZ	Oz Product	R	
4	REV	TOTAL SALES	R	BDX+BDY+OZ
5	MAN	Management Salaries	E	
6	REG	Staff (Regular)	E	
7	OT	Staff (Overtime)	E	
8	PAY	Payroll	E	MAN:OT
9	REN	Rent	E	
10	SUP	Supplies	E	
11	EXP	TOTAL EXPENSES	E	PAY:SUP
12	NET	NET INCOME	R	REV-EXP
13	HC	Headcount	H	

Figure 4. All quantities must be defined before figures are entered.

Conclusions

● Oz represents the first of a new generation of specific management tools. Within its particular sphere of company-type accounts, it presents a full and detailed analysis.

● It is not totally user-friendly since it is possible to degrade some of the input formats with strings that are too long. However, frequent use will probably ease some of these problems.

● It has excellent graphics and an aesthetically pleasing use of colour.

● It will not tell you anything which somebody in your organisation would not have known already, but Oz will make that information readily available to you.

● It is not a straight integrated package, and lacks certain facilities. When it is enhanced, it will be very powerful indeed.

Discriminating experts

Chris Naylor consults two expert systems differing in price more than capability.

BEFORE YOU stands a person — a perfectly ordinary person in many ways. Suppose that you had to decide whether they were male or female. You can look at them, examine them from every angle, take whatever measurements you think might help you in making your decision. Most of the time you would be able to make a perfectly adequate decision straight off — one glance should suffice.

But suppose that this person happened to have died several thousand years ago. How, then, would you make your decision? Some of the most crucial evidence would have long ago vanished away to dust.

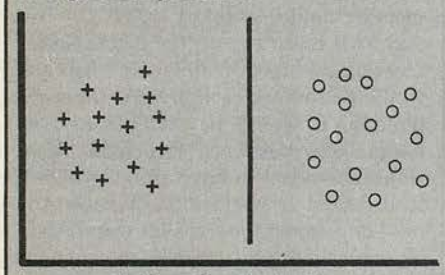
Now suppose that you are asked if it is going to rain on July 1, 1979. That would take a little more thought but it would not be impossible: you could just look up the weather records for that date and give a definite answer. Unless, of course, you happened to be asked the question on the last day of June 1979, in which case this one piece of crucial evidence would again be missing.

Now consider a third problem: you have to decide whether a patient has gallstones or not. No evidence at all is missing in this case because the questioner has thoughtfully provided you with a mass of data on the patient. You have the case history, signs and symptoms, X-Ray report, urine analysis — everything. But although all of the evidence is there, in your medically untutored state you do not know which bits of evidence are important and which can be ignored. You are swamped with data.

Each of these examples illustrate the problem of discrimination: between male and female, between rain and no rain, between gallstones and good health. Every

Discrimination

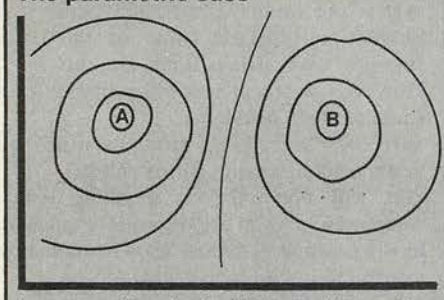
The general problem



In general, the discrimination problem is an attempt to separate two groups of objects. In the figure these objects are measured on two variables — or two dimensions — and it is possible to discriminate between the two groups simply by drawing a line between them.

In practice, there may be more than two groups of objects, but in a clear-cut example like this it is easy to decide exactly where to draw the separating line.

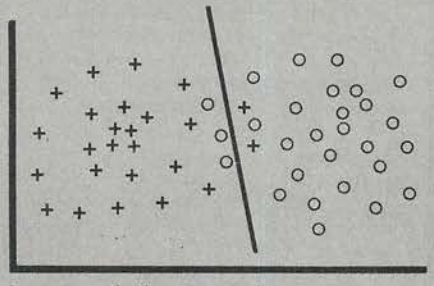
The parametric case



In many discrimination problems it is possible to assume something about the distribution of the variables upon which the objects are measured. A typical assumption may be that the variables are normally distributed. When a known distribution can be assumed the analysis may be parametric, using statistics based on known parameters for the distributions of the objects. When this is the case, it is very much like having n sets of objects each with their own particular contour lines to indicate the probability of an object belonging to any particular class.

A good discrimination method might then be to find the equal contour line between the two groups and use this to discriminate between the classes of objects. Every time a discrimination decision is made, it is possible to say with what probability that decision is likely to be correct.

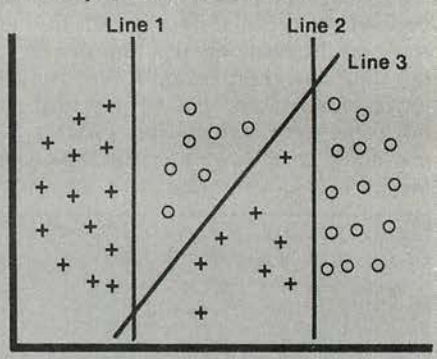
Non-separable classes



In general, there may be a considerable amount of overlap between the two groups. Little or no information may be available about the underlying distribution of the measured variables, so parametric statistics cannot readily be used.

In this case a non-parametric method has to be found to separate the two groups. Not only may the method make mistakes, it may also prove to be difficult to estimate just what the probability of a mistake is in any given case. Overall, the method might work well — it is just that we might not know how well it is working on any particular example.

A non-parametric method



Most parametric discrimination methods attempt to solve the problem by drawing a single line or curve between the two groups of objects and many non-parametric methods try to do the same.

However, some non-parametric methods make use of the fact that there is no necessary reason why one single line should be used. In this example line 1 is used as a first cut in the discrimination process.

day, in hundreds of different ways people make discriminatory judgements. As these examples illustrate, there are many cases in which such judgements are difficult. Anyone capable of offering good judgements in these matters qualifies as an expert in that field.

Wouldn't it be nice to have a computer to make good judgements for you? Then you could think of that computer as an expert and there would be no need to wear out your brain cells trying to do what the computer could do. The ability to make good, expert judgements is, in many cases, right at the heart of an expert system.

Real problem

Perhaps this sounds a little removed from the usual world of computers and programming. It isn't really, but the connection is not usually made explicitly. For a start, consider the If statement as in

```
IF X = 0 THEN ...
```

That is an example of discrimination. The program discriminates between cases in which X is zero and in which X is non-zero. Discrimination is something that you are already doing in your programs.

From this rather trivial example we can now turn to the subject of discrimination as it is usually taught — especially to statisticians. In general, the problems involving discrimination consist of a set of two or more classes of objects in which for each object there is a set of measurements available; the problem is to allocate each object to the correct class on the basis of its measurements.

If you look at some of the examples in the box on the left you will see a broad overview of some of the methods that have been used at various times to solve this problem. In general they tend to be esoteric and, probably for that reason, have so far attracted little popular interest.

It would be handy if these methods could be implemented on a home micro so that you could use them without having to understand the maths behind it all. Then you would be able to predict the weather, or determine the sex of ageing skeletons, or diagnose gallstones — indeed solve any number of problems which were previously beyond you. This is the thinking behind Expert-Ease and Hulk, the two packages reviewed here. Both attempt to provide a general-purpose method for discriminating between objects in a wide range of situations.

In general terms, both Expert-Ease and Hulk work in the same way. You provide the program with a sample of objects upon which you have made certain measurements. For this initial sample you know which classes the objects belong to. Then, using the programs, a method of discrimination is developed which will enable the program to classify the objects you have given it. Then, keeping your fingers crossed, you hope that the method developed will also apply to other objects whose correct classification is unknown.

So you could provide sample data based on the measurements of skeletons whose sex was known, in the hope of developing a method which would later enable you to sex skeletons in general. Or you could provide some weather data from the past in the hope of being able to predict the weather in the future. Or, again, you could provide it with some case histories of gallstone and non-gallstone patients in the hope of finding a good method of diagnosing gallstones in future patients.

Can it be done?

It all sounds like pretty good stuff — but a few words of caution are in order. The first thing to remember is that not all objects are intrinsically separable from a given set of measurements. Consider the problem of distinguishing between birds and planes: if the only measurement you have is the Boolean quantity Wings/No Wings then the two groups of objects cannot be separated using the data at your disposal. That may be an extreme example, but many objects can be intrinsically hard to separate totally.

Some methods of discrimination are better than others. The catch here is that there is usually no single method that is better or worse than any other — it all depends on the data you have. For instance, a parametric method based on the normal probability distribution can give results which are second to none, but only if the data is normally distributed. Most data

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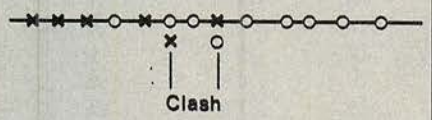
Objects to the left of it all belong to the first group while those to the right of it remain a mixture. Line 2 improves the discrimination, inasmuch as objects to the right of it belong to the second group, leaving only the middle ground to represent uncertainty. Line 3 finally discriminates between those objects falling between the first and second cuts.

An impossible case



Consider this example of two groups of objects measured on only one variable. Clearly no single line would separate them. By using multiple cuts it would be possible to achieve better discrimination, but it may prove necessary to make as many cuts as there are objects in the samples, in which case the method reduces to naming each object and developing a rule for each individual point.

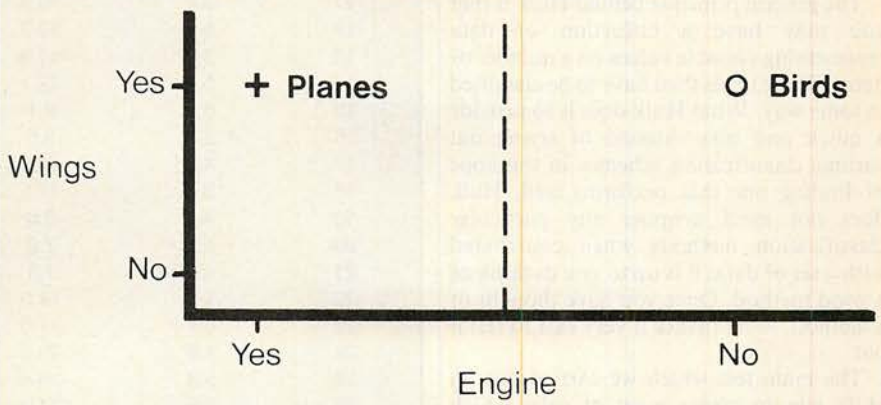
Even this method may not work if two points happen to occupy exactly the same location, in which case these two points cannot be separated by any means and there is an insoluble clash. Further, if the points occupied by the objects had only been approximate anyway then the method used might separate the original group but might not prove to be applicable to any other similar samples.

The Bird/Plane problem

Given an object, you have to decide whether it is a bird or a plane. Birds have wings and no engine; planes have wings and an engine. Using the following data:

Birds: sparrow, tit
Planes: Comet, Harrier

Birds have: wings, no engine
Planes have: wings, engine



This trivial example serves to demonstrate that discrimination methods are equally applicable, in general, to non-probabilistic data. In this case there is no doubt at all about the correct classifications and all of the quantities are Boolean. Yet the problem can still be seen as one in which a dividing line or rule must be found which will discriminate between two classes of objects measured in a two-dimensional space.

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is not, even if statisticians wish it were otherwise.

If a method is to be generally applicable to a large range of problems it usually has to use a non-parametric approach which assumes nothing in particular about the data it is working on. This allows a general-purpose approach but can lead to results which are in some cases inferior. The most usual problem arises when the method simply is not sure about the answer. Non-parametric methods often fail to provide any way of saying exactly how uncertain the answer is except that it may be possible to make a statement about the soundness of the answers in general, rather than a specific statement about each answer in particular.

On the brighter side, plenty of problems in discrimination are easily soluble. Take the question of whether or not you should go to the cinema this evening. Do you like going to the cinema? Is there a film on you haven't seen? Do you have the necessary funds? Is there anything else you should be doing? If the answers are Yes, Yes, Yes and No then you go to the cinema. If they are No, No, No, and Yes then you don't.

This is an example of discrimination at work. There are four Boolean variables, and the discrimination task is so simple that almost any method would work on the problem. If you can devise a program which will ask you those questions and offer cinema-going advice on the basis of your answers, then you have a primitive expert system.

Hulk

The name derives not from the comic strip but from the fact that it helps uncover latent knowledge. Hulk comes on cassette with a fairly slim manual so it could be run on a cassette-based system. However, it is recommended that you transfer the original cassettes to floppy disc and then run from there.

The general principle behind Hulk is that you may have a collection of data representing variable values on a number of items. These items then have to be classified in some way. What Hulk does is to provide a quick and easy method of trying out various classification schemes in the hope of finding one that performs well. Hulk does not itself propose any particular classification methods when confronted with a set of data; it is up to you to think of a good method. Once you have thought of a method, Hulk makes it very east to test it out.

The main test which we carried out on Hulk was to create a set of rules which would help to predict whether or not it would rain tomorrow. The test data, shown in figure 1, consists of data for the 31 days of March 1982. It includes minimum temperature, maximum temperature, rainfall, sunshine and a fifth variable showing whether or not it rained the following day. These figures originated from the London Weather Centre.

The first task was to get this data into the machine. It is entered a format very much like the lines of Basic

```
10 WEATHER, 31,5
20 MINTEMP
30 MAXTEMP
40 RAINFALL
50 SUNSHINE
60 RAINDUE
70 D1, 9.4, 11.0, 17.5, 3.2,1
....
370 D31, 4.6, 9.6, 3.2, 4.2, 1
```

In plain words this says there are 31 samples in the data set, each of five items. The five items are named in separate lines, which are followed by 31 lines each giving the values on these items for one of the samples. The data is then saved on a disc file. It is hardly elegant, but it works.

The next stage is to run a program called Prescan. It first asks what hypothesis you want to test. To test the hypothesis that it rains tomorrow reply

RAINDUE = 1

Any hypothesis involving arithmetic or logical operators on any of the five named variables could have been set up for the test. Prescan does a preliminary check through the five variables to see which, if any, might act to distinguish between those days on which rain followed and those days on which it did not. It is done by carrying out an approximate t-test on each of the five variables in turn to see which gives the highest score.

In this case Prescan suggested that the variable Rainfall would be worth investigating because high rainfall figures for one day seemed to suggest rain was due the next day. It also suggested that Rain Due was another good variable to look at.

The next program, called Look, prompts the user to provide rules which it then tests out against the data to see if they are any use at predicting the hypothesis — that is of discriminating between days for which rain is due and days for which it is not. Rules could be any combination of arithmetic or logical operators. So, keying in

RAINFALL > 1

as rule 1 tests the prediction that rain is due if today's rainfall is greater than 1mm. The Look program then assesses this rule against the examples it had been given: it found that it could predict tomorrow's rainfall in 24 out of 31 days and advised that the rule be retained. A number of other rules were proposed, most of which did little, if anything, to help matters. Look suggested that these rules should be abandoned.

Eventually, two more rules were unearthed which did help to improve the score and which Look advised the user to keep. They were rule 2:

((MAXTEMP – MINTEMP)/MINTEMP)* 100 > 40

and rule 3:

SUNSHINE > 3 AND MAXTEMP < 10

which improved the forecast to 26 days correct out of 31. Rule 2 indicates a wide range of temperature variation during the

Day	Min temp °C	Max temp °C	Rainfall mm.	Sunshine (hours)	Rain tomorrow
1	9.4	11.0	17.5	3.2	yes
2	4.2	12.5	4.1	6.2	yes
3	7.6	11.2	7.7	1.1	yes
4	5.7	10.5	1.8	4.3	no
5	3.0	12.0	0	9.5	no
6	4.4	9.6	0	3.5	no
7	4.8	9.4	0	10.1	yes
8	1.8	9.2	5.5	7.8	yes
9	2.4	10.2	4.8	4.1	yes
10	5.5	12.7	4.2	3.8	yes
11	3.7	10.9	4.4	9.2	yes
12	5.9	10.0	4.8	7.1	yes
13	3.0	11.9	0.2	8.3	no
14	5.4	12.1	0	1.8	yes
15	8.8	9.1	8.8	0	yes
16	2.4	8.5	3.0	3.1	yes
17	4.3	10.8	4.2	4.3	no
18	3.4	11.1	0	6.6	yes
19	4.4	8.4	5.4	0.7	yes
20	5.1	7.9	3.0	0.1	yes
21	4.4	7.3	1.0	0	no
22	5.6	14.0	0	6.8	no
23	5.7	14.0	0	8.8	no
24	2.9	13.9	0	9.5	no
25	5.8	16.4	0	10.3	no
26	3.9	17.0	0	9.9	no
27	3.8	18.3	0	8.3	no
28	5.8	15.4	0	7.0	yes
29	6.7	8.8	6.4	4.2	no
30	4.5	9.6	0	8.8	yes
31	4.6	9.6	3.2	4.2	yes

Figure 1. Data for weather-prediction problem.

day, and rule 3 indicates that the day was sunny but cold.

The selected rules are saved in a named rule file and you are then ready for the final stage, which is to run the program Leap. This program takes a data set and a rule set from existing disc files and applies the rules to the data, giving a classification for each data item according to the rule set.

In general, given the nature of this test data, the results obtained using Hulk are good. There is a distinct limit to the ability to predict rain on the morrow from data like this and that limit probably does lie around the 75 percent correct level.

A second test gave more ambiguous results from the simple task of identifying whether an object was either a bird or a plane. The data used was

```
10 BIRDPLANE, 4,4
20 BIRD
30 PLANE
40 WINGS
50 ENGINE
60 SPARROW, 2,0,1,0
70 TIT, 1,0,1,0
80 COMET, 0,1,1,1
90 HARRIER, 0,1,1,1
testing the hypothesis
                BIRD = 1
```

The problem lies in the fact that Prescan, in carrying out an approximate t-test, assumes that the variables have a non-zero standard deviation, which these variables do not. On finding a standard deviation of zero the t-test scores go to infinity — or at least to the limit of the machine's range — and every variable is then reckoned to be important enough to warrant investigation. So, according to Prescan, variable Wings should be investigated, which is clearly wrong.

Even without Prescan's help it was possible to devise a set of workable rules as the methods used by Look and Leap make no assumptions about the data. They simply set up a two-by-two contingency table showing which data items are correctly classified according to the current rule set, and which are not. From this, they estimate the overall probabilities of each rule set giving correct classifications.

Hulk does not give an exact probability estimate on individual items of data in the data set. For instance, it does not say exactly what the probability might be of rain following the weather given in, say, day 3. It simply gives a prediction for day 3 that rain will follow on the basis of whether or not it satisfies the rule set. It is very much an all-or-nothing decision which is likely to give good results on a large number of examples.

In many ways Hulk can be thought of as a batch process. You give it a file of test data, develop a file of rules and then implement these rules on a new file of data. There are no facilities for wandering up to the machine with a single example and asking it what it thinks about it. Even a single example would first have to be turned into a Hulk-format file. Hulk's strong point is the ability to try out different rules rapidly on a set of data to see whether they are any good. It is very quick and interactive and justifies its name — it does help uncover latent knowledge.

Apart from predicting the weather and deciding if a tit is a bird or a plane, people may well wonder what they could do with Hulk. The National Coal Board has used it for categorising samples of coal: from a chemical analysis of coal samples Hulk developed a set of rules from which the NCB could determine which pit any coal sample came from.

As with any general-purpose tool the uses it could be put to depend as much on the user's imagination as anything. A credit-control manager who wants to identify risky customers might think that marital status could do the job, or perhaps income, or age. Given a set of test data to work on it would not take long to test and refine the rules used to assess creditworthiness. It is just another example of what is, in statisticians' jargon, a classification or discrimination problem. Think of another classification problem and you have another application: there is no definitive list of application areas for Hulk.

If Hulk were being sold at a much higher price than £25 there would still be a hard core of interested purchasers. It can genuinely help people to make sound decisions — and bad decisions are extremely costly in many enterprises. The £25 price tag suggests there is more than a touch of idealism to it. A large number of people will be able to have a go and get the feel of this still uncommon type of product.

Expert-Ease

Expert-Ease comes on disc with an exceptionally clear and unambiguous manual. It is hard to imagine that anyone would have the slightest difficulty in using the system.

As in Hulk, there are two main stages to using Expert-Ease. In the first stage, you give the program some examples of the problem you wish it to work on and, from them, a series of rules is developed to distinguish between different classes of objects. In the second stage, these rules can be applied to new data to help you draw conclusions from it. Unlike Hulk, Expert-Ease does not leave you to your own devices when it comes to dreaming up the appropriate rules. Expert-Ease does this automatically using non-parametric methods.

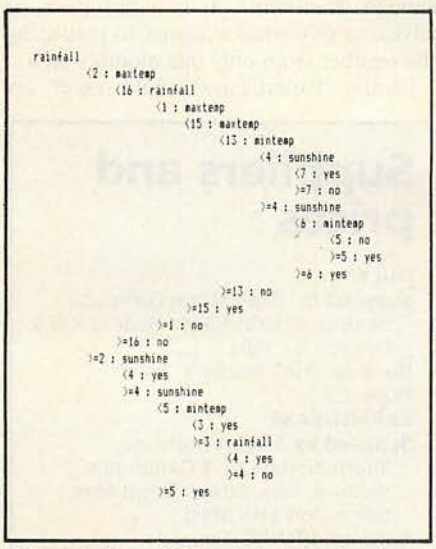

Figure 2. Expert-Ease induces rules from raw data you supply to it.

Expert-Ease offers four main screens. The File screen shows the names of all the problems held on disc to date; the Attribute screen is used to define the variables to be used in any given problem; the Example screen is used to input examples from which Expert-Ease will build up its discriminatory rule set; and the Rule screen is used to display the rules which Expert-Ease has developed for your problem. The screens are pretty well self-explanatory for the user. You kick off by defining the variables involved on the Attribute screen and giving some examples on the Example screen. You can then look at the rules which Expert-Ease has drawn up for you on the Rule screen.

Refinement

You can refine the rule by adding small sections of text here to turn them into a neat query system which will interrogate the user interactively on a novel problem of the type you have just defined. An enquiry system is then generated automatically by Expert-Ease, and from then on you have your very own expert sitting on your desk ready to work on any example of this type of problem you might want to give it.

On booting the system you are first shown the File screen displaying all current problems held on the disc. If you want to start a new problem key A to enter the Attribute screen, where you can start to define it. Like the other screens in this package, the Attribute screen is made up of a series of cells in a VisiCalc-like structure which is as easy to manipulate.

You start by entering headers across the top of the screen to define the variables. For the Bird/Plane problem they are Wings, Engines and Object. For each of these variables enter values which the variables can take: Wings can take the values Yes or No, as can Engine: Object can take the values Bird or Plane.

The right-hand column is always assumed to be the hypothesis under test; in this case the hypothesis is that the object is either a bird or a plane. The preceding columns can refer either to logical or integer values. In this case all of the variables are assumed to be logical because entering values Yes or No indicates the finite range of possibilities for these variables. If you do not enter any values for these variables the system assumes them to be integer variables in the range 32,768 to −32,768.

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Key E to enter the Example screen. In this case you enter a couple of examples — a bird and a plane — showing that a plane has wings and an engine whereas a bird has wings and no engine. When you key ! Expert-Ease sets about inducing a rule by which it can tell the two objects apart.

Keying R takes you to the Rule screen, where you can see the induced rule. It looks good: the rule only considers the variable Engine, and decides that if it has one it's a plane and, if it doesn't it's a bird.

Now key Q to enter the query system, which runs this miniature expert system interactively. Each time you run it it asks if the object has an engine or not and, depending on the answer, pronounces it to be a bird or a plane accordingly.

To return to the File screen, key F. You can Save this problem so that it will appear on the File screen as one more area of expertise for Expert-Ease.

Rainfall

A similar procedure is followed for the rainfall-prediction problem. An Attribute screen shows the variables Mintemp, Maxtemp, Rainfall, Sunshine and Raindue. The first four variables are integer variables as they could take any numerical value: the hypothesis under test, in the last column, is a logical variable which takes only the values Yes or No.

The sample values are entered on the Example screen. They are the same examples that were given to Hulk, truncated to integer values. Reals are accepted neither by Expert-Ease nor by Hulk, so the test remains the same for both products. When all the data has been entered, key ! and sit back for a minute or so while the machine tries to unravel the complexities of weather forecasting and induce a rule. Then key R to look at the rule it has induced — see figure 2.

At this point two distinct points emerge. I was genuinely surprised that Expert-Ease managed to induce a rule for this data without blowing a fuse in the process. The thinking behind Expert-Ease is that there is a definitive rule which will correctly classify every object given to it as an example. With such a diffuse problem as weather forecasting, this is no mean feat.

Common sense

There is a marked similarity between the induced rule and rules which might have been suggested by common sense — which is a virtue, not a fault. The first item it always looks at is the question of Rainfall. If it is less than 2mm. it passes into one section of the decision process; if it is greater than or equal to 2mm. it passes to another section. The rule which Hulk liked made a decision on the basis of rainfall being greater than 1mm. or not. Both rules correspond with the common-sense knowledge that rain tends to go in spells. Expert-Ease has produced, of its own accord, something which seems eminently sensible.

Some nice points emerge from Expert-Ease's rule. For instance, if rainfall is greater than or equal to 2mm. and sunshine is greater than or equal to five hours then it will predict rain. These figures are for March weather, and you can almost see the sunny, rainy days that Expert-Ease seems to have in mind. Or consider the case of rainfall less than 2mm. and maximum temperature greater than or equal to 16°C, you can envisage a dry, warm day, rather settled weather for which Expert-Ease would predict a dry day to follow. The rules which Expert-Ease has induced are undoubtedly interesting in themselves, and studying them might well help to throw light on the underlying situation.

Keying Q to enter the Query system, and entering the data for March's weather again gave a 100 percent accurate prediction of every day's weather. However, running the same query system on fresh data — in this case the weather figures for the following month, April — gave less than perfect results.

Expert-Ease then made 18 correct predictions out of 29 — a score of only 62 percent. With a much simpler rule, Hulk was right in 28 out of 29 days.

Testing the two systems with the same type of problem helped to produce a comparative review, but there are differences in the type of problem to which each is most suited. Expert-Ease can show you what problems it is intended for if you run one of the expert systems supplied with it called Problems.

Suitability

Running Problems on the Bird/Plane problem suggested that this problem was suitable. Running Problems on the weather-forecasting problem suggested that Expert-Ease would not have been suitable in this case. "You will get an unacceptable level of wrong answers because your examples do not cover enough situations". It is a fair piece of advice to give when it comes to predicting the weather from only one month's data.

Clearly Expert-Ease would excel on problems which have strictly defined conditions associated with them. To get the most for your money, these conditions should be previously unknown to you. Examples might include the problem of working out a suitable testing schedule for a quality-control process, or generally unravelling some problem which is intrinsically separable — unlike weather prediction — but for which you are unsure about the exact method that might be used to separate the items.

For really complex processes Expert-Ease can unravel rules in situations with up to 31 variables, each of which can have either integer values or a maximum of 255 logical values. It is possible to give it up to 30,000 examples to work from. At the end of the process you have a tailor-made interactive expert system which can be copied on to another disc and given to a naive user, who can then become an expert.

Suppliers and prices

HULK
Supplied by: Brainstorm Computer Solutions, 103A Seven Sisters Road London N7 7QN.
Runs on: BBC Model B, Torch
Price: £25
EXPERT-EASE
Supplied by: Export Software International Ltd, 4 Canongate Venture, New Street, Royal Mile, Edinburgh EH8 8BH.
Runs on: IBM PC, Sirius 1
Price: £1,725, VAT included

Conclusions

● Both Hulk and Expert-Ease are revolutionary in the micro market-place. They assist the user in carrying the discrimination tasks which are at the heart of any expert system.

● Both packages use non-parametric methods which would be broadly applicable to any sets of data, and both work by establishing a rule set from given examples.

● Hulk does not discover discriminant rules for you, it merely makes it very easy for you to test out rules which you think might have some bearing on the case. Expert-Ease, on the other hand, will look for rules, and tries to give perfect results.

● Hulk essentially works in batch mode. You set up files of data and then run the programs on these files. Only the development of the rules is a genuinely interactive process between machine and user via the screen. This makes it more suitable for problems in which reasonably large sets of data are to be examined at one go, rather than for casual enquiries.

● Expert-Ease is interactive in its operations from the start. It is extremely user-friendly and lets you develop a stand-alone expert which can be run on a very casual basis.

● Neither system allows the use of real variables as data. It is not immediately apparent why this should be the case, although most reals could, in practice, be turned into integer values by suitable scaling.

● If Hulk were a little more interactive in the inputting of data and had a query system comparable to that of Expert-Ease as its end result, it could be sold at a much higher price. It is thoroughly recommended, very interesting and likely to undergo continual enhancement.

● Expert-Ease costs nearly 30 times as much as Hulk. It is a very substantial system which is easy to use — and if it were to divide its price by 10 could become a best seller on a par with VisiCalc.

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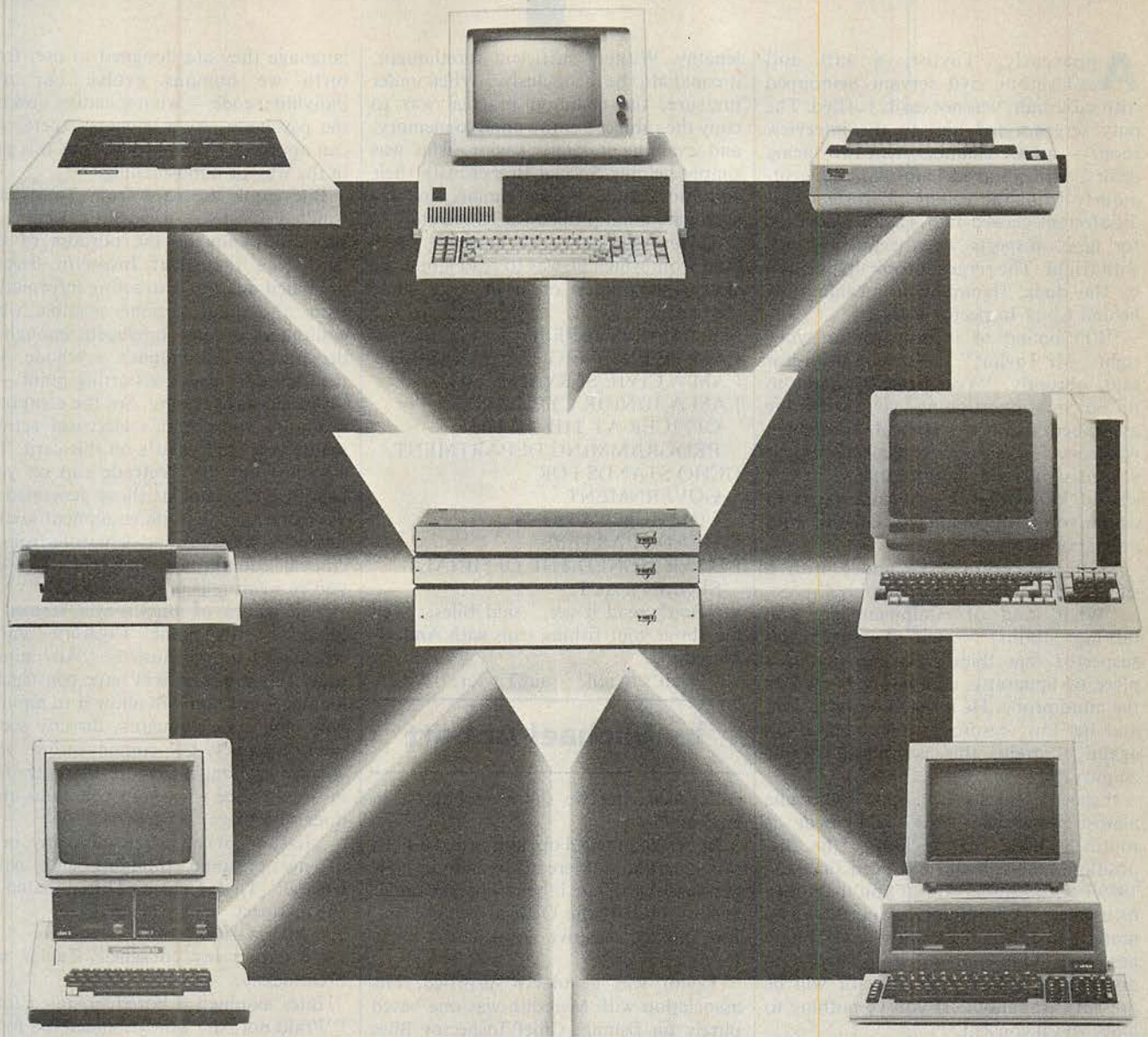

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Mind probe

by Michael Abbott

Apparently, Taylor, a tall and cadaverous civil servant bemopped with sable hair, was not easily ruffled. The duty sergeant led him to the interview room — a bare chamber with two facing chairs, with a naked lamp hanging grotesquely from the ceiling. The stench of disinfectant clawed into Taylor's nostrils; for here, suspects were frequently sick with fright. The sergeant took up position by the door, slamming it meaningfully behind Chief Inspector Biles.

"I'm bound to inform you of your rights, Mr Taylor," the stubby inspector said, abruptly. "You have the right to refuse our questioning you with the assistance of any technical equipment whatsoever, even a tape recorder. But if you insist on a conventional interview, you should know that I am empowered to detain you until completely satisfied with your statement.

"Off the record," he added with a smirk, "this could be indefinitely."

"What kind of equipment are you talking about?" said Taylor, who suspected that Biles was referring to a piece of apparatus commonly known as the mind probe. He resisted intimidation, and his low, resonant voice started up again. "Surely, this is only a simple enquiry?"

Inspector Biles's frail quaver became almost defensive, "All equipment is routinely used, sir, including the disposition analyser, and has been since the 1989 Police Powers Act. If you'll agree to its use, sir, the full interview need take no more than 15 minutes, and there'll be no need to trouble your solicitor. There's no discomfort, and a police doctor will be present throughout. If you've nothing to hide, you'll consent."

Biles became impatient. Why detainees needed to deliberate was a mystery to him. After all, he had made it clear that the conventional alternative would be stretched so as to detain Taylor beyond endurance.

Taylor had barely consented when the equipment trolley was wheeled in, accompanied by a female doctor offering a mawkish smile. The transferral to a reclining couch, and the fitting of a hideous electrode cap, fractured Taylor's composure. His voice became as taught as a child's. "Let me get this straight. This machine merely extracts answers to your specific questions?"

"Something like that," Inspector Biles twanged, buoyantly.

The doctor raised an eyebrow. The approved procedure was inconvenient and lengthy. Without sufficient forethought, it could also be inconclusive. When under pressure, the common practice was to copy the subject's entire mind to memory, and examine it later. Taylor, who was simply helping Special Branch with their enquiries, could be sent home, and his surrogate mind probed for its secrets.

Taylor was shown an unwieldy black card from which he was to read aloud the statements printed on it in large white characters.

MY NAME IS JEREMY TAYLOR
I AM TWENTY-EIGHT YEARS OLD
I AM A CIVIL SERVANT
I AM A JUNIOR CYPHERS
OFFICER AT THE GCHQ
PROGRAMMING DEPARTMENT
GCHQ STANDS FOR
GOVERNMENT
COMMUNICATIONS
HEADQUARTERS
I HAVE SIGNED THE OFFICIAL
SECRETS ACT

"Don't read it yet," said Biles, "Tell me about your fishing trips with Andrew Meredith."

"What's to tell?" said Taylor. "We are colleagues, and we share an interest in angling."

Biles straightened up, and issued a stern proclamation, "Meredith is here in New Scotland Yard, and is being charged under Section One of the Official Secrets Act, for leaking sensitive information to a foreign power."

Taylor was genuinely surprised. His association with Meredith was one based purely on fishing. Chief Inspector Biles resumed his all-knowing smirk. "Long boat trips, eh? Ideal for exchanging information and ideas without being bugged. Surveillance is difficult, even for the security services, when you're sitting in a row-boat in the middle of a lake."

Taylor twitched. Not at the accusation, but because the probe had been activated. Biles handed him the big black card. "Read it!"

Taylor read it, and then repeated the alphabet three times, as requested. Chief Inspector Biles explained, "As a computing and cyphers operative, perhaps an explanation will not be wasted on you, Mr Taylor." Biles lit a cigarette before continuing, "You see, the problem with reading a person's mind is that everyone thinks with a language of their own. Unlike computers, which think with the machine language they are designed to use, from birth we humans evolve our own individual code — what scientists now call the psychode. As a cyphers expert, you can appreciate the obstacle that this puts in the way of mind-reading."

Biles took the card from Taylor and fondled it absent-mindedly. Taylor insisted on knowing the purpose of this card, and the Chief Inspector became animated again. "Extracting information from the mind became possible when computers became intelligent enough to decypher an individual's psychode. But the computer needs a starting point — a set of clues, as it were. So, the computer, monitors your brain's electrical activity whilst you read what's on this card. The signals from the electrode cap on your head are the same as those generated by electroencephalograph equipment used in hospitals. There is one departure from its clinical counterpart, however. The cap you're wearing is bi-directional."

The whites of Biles's eyes seemed to bloat at this point. Cigarette smoke streamed from his nostrils. "Any minute now, this machine will have constructed an algorithm that will allow it to monitor your conscious thoughts, directly access your memory by circumventing your conscious thoughts, and evoke memories in order to see what your conscious mind does with them."

"In short, it can help itself to any, or all of my personal thoughts and experiences?" Taylor croaked, humiliated by the prospect.

"Affirmative!"

"I retract my consent," Taylor said breathlessly.

Biles assumed a bored, irritated tone, "'Fraid not, sir. You've signed the form. If necessary, I can use restraint." He summoned the sergeant as a show of force.

Phase two of the mind probe commenced. The subject's mouth hung open as the soporific tingling sensation intensified. He heard the computer's voice somewhere in his mind, saying blandly, "Relax, Mr Taylor. Just relax."

The experience is not one that can be meaningfully related, save to say that images, sounds, and long-abandoned memories spring in and out of consciousness like accelerated dreams. A peculiar awareness that something is helping itself to your private thoughts accompanies the waves of voices, faces and startling visions. Frequently, there are physical manifestations in the subject, and Taylor

was no exception. He began talking to himself, then he cried out, sang, and laughed heartily. The doctor mopped saliva from his chin. It was a sight that disturbed even Biles.

When the probe was completed Taylor slept for three or four hours. By the time he awoke, Biles and the sergeant were at the probe console, studying their detainee's mind. Taylor's weaknesses and strengths, be he incriminated by the probe or not, would be passed on to New Scotland Yard's database.

Music floated down the corridor behind the sergeant, reaching Taylor's ears as the officer entered bearing a cup of tea. "Doctor says you can go as soon as you feel up to it," the sergeant said. "I must compliment you on your memory for music, sir. It's just like listening to the real thing."

As Taylor left, the sergeant was recalled to the console. Biles had become excited about something.

"Usual thing until now, sergeant," Biles was pointing at the screen. "Likes golf and fast cars. Thinks his wife is sexually boring. Fancies himself at squash. But look at this one. She's a hooker. Our friend goes on regular sorties into the Earls Court red light district."

Biles rubbed his chin angrily. "Guys like Taylor are time bombs waiting for a subversive somewhere to light their fuse. He's wide open to corruption. I'm going to ask the computer to set up a scenario. Mark my words, sergeant, you're about to see Taylor sell a state secret — not for money, nor in the face of violence, but for services rendered. I'm going to arrange a seduction, and see Taylor move in."

"Not Taylor, sir, but his surrogate," the sergeant added plaintively. "It all happens inside the computer, not in real life."

"Same thing," said Biles. "The computer is capable of simulating Taylor's decision-making processes. After all, a human being's thinking is conditioned entirely by his experiences, and our computer has all of Taylor's experiences at its disposal. The Taylors of this world are law abiding by default. They are circumstantially innocent. Anyone who is potentially willing to commit a crime at the right price is a criminal."

The sergeant found his superior's attitude distasteful. "Hardly fair, sir. The computer can romp around Taylor's memory seeking out his weaknesses and fears. What chance would any human stand? So what if he performs as you suspect, sir? He can't be charged. He the right price is a criminal."

"No, but he'll cease to be a civil servant. In fact, he'll never hold a position of trust again. Either way, sergeant, the information concerning personality will be secured with Scotland Yard, and surveillance will do the rest."

The sergeant cleared his throat in readiness to make an impertinent remark. "Are you sure such information would not be more secure left inside Taylor's head, sir — how secure is New Scotland Yard's database? I've heard worrying stories about unauthorised taps. If they're true, we could actually be giving our adversaries a leg-up."

Chief Inspector Biles gave the young sergeant a long, hard look, before replying. "You've been with Special Branch five minutes, sergeant. What makes you think you're in a position to improve the procedures already? I'd be interested to hear. I don't care what you've read in the fringe press, you can take it from me, no one accesses police or government databanks without authorisation. No one. Every precaution is taken."

Taylor was about to sip his coffee when he heard a noise in the hall. More mail? He switched off the TV, yawned, and went to the front door. There on the mat was the now commonplace pile of envelopes which he would have to sift through before his wife became curious.

Three envelopes contained exotic funware catalogues; one other a West End contact magazine. There were also two golfing accessories special offers and a magazine for sports car owners. He rolled up the saucy brochures, furtively poked them into his dressing-gown pocket, and returned to the kitchen. There he sat with his toast and marmalade, reading the sports car journal.

Since the police enquiry, Taylor had been dismissed from his job in Cheltenham, and had become the target of numerous commercial enterprises that seemed to know an awful lot about him. He had his suspicions, but like the others to whom this had happened, it was prudent to remain silent.

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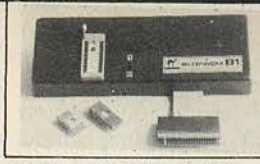

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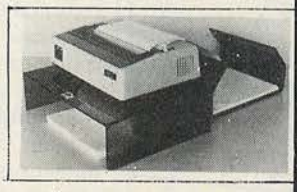

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The following features were considered essential:

— an 80-column display;
—quicker and easier editing than the standard BBC Copy and Delete keys provide;
— support for special printer control codes, albeit rather limited ones on the Tandy Line Printer VII used while the program was being developed;
— ability to save and load text using named files.

A means of assigning commonly used strings to the function keys was also included. Features such as full-screen editing, automatic justification and others found in full-scale word-processing packages were ruled out by the need to retain a reasonable amount of memory for the text. The program as it stands allows some 80 lines or more of text to be handled in a single file.

When the program is run, the first display selects whether a new file is being set up, selection I, or an existing file loaded, selection L. In the latter case the file name is then input and the file is loaded.

Cnn — change line nn; includes deletion or reproducing with a different line number
Ann — add a new line nn, and renumber all succeeding lines
Lnn — list the text on the screen, starting from line nn
P — print the text on the line printer
S — save the text file
K — define the contents of function keys
E — end the program

Table 1.

The main display shows up to 20 lines of the text, with line numbers — which are not stored as part of the text — and an input line which is used to select all the remaining functions of the program. The functions available are shown in table 1.

Functions P, S, K and E have further menus to control their use. Functions C, A and L expect a line number; if one is not supplied, the program defaults to one based on the line number of the preceding function:

— for function C, the same line number is used;
— for function A a line number 1 higher is used;
— for function L a line number 19 higher is used, subject to not exceeding the highest line number in the file.

If no function code is entered the previous function is repeated with the default line

(continued on page 120)

Procedures

ProcStart, line 260. Sets up user-defined characters for the special characters ASCII 128-132 and 146; initialises some variables; determines whether a new file is to be set up or an existing one loaded.

ProcInit, line 440. Performs basic initialisation of the environment.

ProcLoad, line 510; and ProcSave, line 580. Load and save the text file.

ProcMsg, line 680. Receives a message as a parameter, which is displayed in reverse colours on line 21.

ProcList, line 720. Displays up to 20 lines of text on the screen, ensuring that the most recently processed line is within the displayed text.

ProcSet, line 820. Prompts for input of the function to be performed next and checks for a valid selection.

ProcAdd, line 940. Adds a new line to the text file, making space by shifting the array along one place. The new line is all blank.

ProcChg, line 1000. Creates a string in the work area addressed by W%, containing the line number and the text of the line. Prints this line at the bottom of the screen and positions the cursor at the start of the text, c = 5, using a VDU 31 command. In the Repeat-Until loop in lines 1070 to 1190, a character is input from the keyboard and acted upon . The character is placed into the text string — except cursor-control keys, which do not affect the text — and the changed character is printed. Line 1150 is the process for the Delete key which closes up the text, and line 1160 for the Copy key which inserts blanks in the line. Line 1130 processes the Ctrl-f2 input and flags the start of the line with CHR$146 to signal deletion of the line. When the Repeat-Until loop is complete, the changed line is usually replaced in the text. If the first position is flagged with CHR$146 the line is deleted from the text array; if the line number has been chaged it is added with its new line number, the old line remaining unchanged.

ProcCr, line 1300; ProcCl, line 1330; ProcDel, line 1360; and ProcDup, line 1400. These procedures are used by ProcChg.

ProcPrint, line 1440. The hard-copy print procedure. The line is actually printed by ProcPrintline, line 1610, which may need to be changed, depending on the printer being used. ProcPrintline expects the string to be printed to be at the address in X%. It prints the string up to the first character which needs to be translated into special codes for the printer and outputs the codes relevant to that special character. It then updates the value of X% to point to the next character and calls itself again to continue printing the string. The printer codes may need to be changed for printers other than the Tandy Line Printer VII. In line 1740, 31 means switch to double-width characters; in line 1750, 30 means switch to normal-width characters; line 1820 prints a horizontal line for underlining; line 1830 prints a £ sign in dot graphics.

ProcEnd, line 1850. Allows the file to be saved and processing continued either with this file or restarted from scratch.

ProcDefkey, line 1900. Defines the function keys as required. A call to the OSCLI routine is used to assign the string variable to a key.

ProcRestart, line 2020. Not called from the program: used to restart the program if it terminates for any reason, by entering a command ProcRestart, which initialises the environment correctly without clearing any variables.

```
   10 REM Text Processor
   20 ONERRORGOTO200
   30 MODE3:M%=87:W%=&D00
   40 DIMt$(M%),sc$(5)
   50 PROC_start
   60 REPEAT:PROC_list:PROC_ms9("No of
lines: "+STR$(n))
   70   REPEAT:PROC_sel
   80     IFs$="A"PROC_add:PROC_ch9
   90     IFs$="C"PROC_ch9
  100     IFs$="L"t=i
  110     IFs$="P"PROC_print
  120     IFs$="S"PROC_save
  130     IFs$="K"PROC_defkey
  140     IFs$<>"E" PROC_list
  150     UNTILs$="E"
  160   PROC_end
  170   UNTILs$="E"
  180 RUN
  190
  200 IFERR=17 VDU3:CLS:PRINT'"Press RE
TURN to continue, SPACE to end.":REPEAT
:a=GET:UNTILa=13ORa=32:IFa=13 GOTO60
  210 VDU26:@%=10:CLS:REPORT:PRINT" at
line ";ERL
  220 *OPT
  230 *FX4,0
  240 END
  250
  260 DEFPROC_start
  270 *FX226,128
  280 *FX227,144
  290 VDU23,128,65,65,73,73,54,0,127,0
  300 VDU23,129,62,64,64,64,62,0,127,0
  310 VDU23,130,72,36,18,9,18,36,72,0
  320 VDU23,131,8,8,73,42,28,8,127,0
  330 VDU23,132,255,0,0,0,0,0,0,0
  340 VDU23,146,170,85,170,85,170,85,17
0,85
  350 PROC_init
  360 b$=STRING$(75," "):f$=LEFT$(b$,8)
:s$="A"
  370 sc$(0)=CHR$128:sc$(1)=CHR$129:sc$
(2)=CHR$130:sc$(3)=CHR$131:sc$(4)=CHR$1
32:sc$(5)="^"
  380 FOR I%=1TOM%:t$(I%)=LEFT$(b$,68):
NEXT:i=0:t=0:n=0
  390 CLS:PRINTTAB(24);"Text Processor"
;TAB(24);STRING$(14,"=")
  400 PRINT'"I - Init new text file"'"L
 - Load text file"''"Press ""I"" or ""L
""."''"Press ESCAPE to end."'
  410 a$=FN_key("IL"):IFa$="L" PROC_loa
d
  420 ENDPROC
  430
  440 DEFPROC_init
  450 @%=&303
  460 *OPT1,1
  470 *OPT2,1
  480 *OPT3,10
  490 ENDPROC
  500
  510 DEFPROC_load
  520 b=0:REPEAT:VDUb:INPUT"File name",
f$:b=7:UNTILLENf$>0 ANDLENf$<11 ANDINST
R(f$," ")=0
  530 VDU28,16,22,63,19:CLS:f=OPENIN(f$
):n=0
  540 REPEAT:n=n-(n<M%):INPUT#f,t$(n):U
NTILEOF#f
  550 CLOSE#f:t=1:i=1:VDU26:CLS
  560 ENDPROC
  570
  580 DEFPROC_save
  590 CLS:COLOUR0:COLOUR129:PRINT" Save
 text "'':COLOUR1:COLOUR128
  600 IFf$<="        "PRINT"File has no
 name.":a$="N":GOTO620
  610 PRINT"File name: ";f$;"  OK? (Y
or N)":a$=FN_key("YN")
  620 IFa$="N" b=0:REPEAT:VDUb:INPUT"Fi
le name",f$:b=7:UNTILLENf$>0 ANDLENf$<1
1 ANDINSTR(f$," ")=0
  630 VDU28,16,22,63,19:CLS:f=OPENOUT(f
$)
  640 FOR I%=1 TO n:PRINT#f,t$(I%):NEXT
  650 CLOSE#f:VDU26:CLS
  660 ENDPROC
  670
  680 DEFPROC_ms9(m$)
  690 COLOUR0:COLOUR129:PRINTTAB(0,21);
" ";m$;" ";:COLOUR1:COLOUR128:PRINTLEFT
$(b$,72-POS);:VDUb
  700 ENDPROC
  710
  720 DEFPROC_list
  730 IFt<i-19ORt>i t=i+(i>1)+(i>2):IFt
>n-17 t=n+17*(n>19)
  740 IFt<1 t=1
  750 VDU26:CLS
  760 FORI%=t TOt+19
  770   PRINT;I%,t$(I%):IFI%>=n I%=999
  780   NEXT
  790 IFs$="L" i=t+19:IFi>n i=n-10
  800 ENDPROC
  810
  820 DEFPROC_sel
  830 PRINTTAB(0,22);"A-add  C-chan9e
L-list  P-print  S-save  K-key def  E-e
nd >";:f=FALSE:b=7
  840 REPEAT
  850   PRINTTAB(60,22);"       ";:VDU8,
8,8,8,8:INPUT""i$
  860   IFi$="" THENa$=s$:a=i-(s$="A")
ELSEa$=CHR$(ASCi$AND&DF):IFLENi$=1 THEN
a=i-(a$="A") ELSEa=VAL(RIGHT$(i$,LENi$-
1))
  870   PRINTTAB(0,21);b$
  880   I%=INSTR("ACLPSKE",a$):IFI%=0 P
ROC_ms9("Bad selection "+LEFT$(i$,1)):G
OTO900
  890   IF I%>3 THEN f=TRUE ELSE IF a>0
ANDa<=(n-(a$="A")) AND a<M% THEN f=TRUE
:i=a ELSE PROC_ms9("Bad line no "+STR$a
)
  900   UNTIL f
  910 s$=a$:s=i
  920 ENDPROC
  930
  940 DEFPROC_add
  950 IFn=M% n=n-1
  960 FORI%=n TOi STEP-1:t$(I%+1)=t$(I%
):NEXT
  970 t$(i)=LEFT$(b$,74):n=n+1
  980 ENDPROC
  990
 1000 DEFPROC_ch9
 1010 *FX4,1
 1020 *FX15,0
 1030 REPEAT
 1040   I%=1:IFi<100 I%=2:IFi<10 I%=3
 1050   $W%=LEFT$(b$,I%)+STR$i+" "+t$(i
)+LEFT$(b$,75-LENt$(i))
 1060   PRINTTAB(0,23);$W%;:c=5:VDU31,5
,23
 1070   REPEAT
 1080     a=GET
 1090     PRINTTAB(0,21);b$;:VDU31,c,23
 1100     IFa=9 a=133
 1110     IFa=136 PROC_cl:UNTILFALSE
 1120   IFa=137 PROC_cr:UNTILFALSE
 1130 IFa=146 c=5:?(W%+5)=146:PRINTTAB(
5,23);CHR$146;:VDU31,5,23:UNTILFALSE
 1140 IFa=145 ANDc>4 PRINTTAB(c,23);b$;
:$(W%+c)=LEFT$(b$,80-c):VDU31,c,23:UNTI
LFALSE
 1150 IFa=127 ANDc>4 $(W%+c)=$(W%+c+1)+
" ":PRINTTAB(c,23);$(W%+c);:VDU31,c,23:
UNTILFALSE
 1160 IFa=135 ANDc>4 $(W%+c)=" "+LEFT$(
$(W%+c),78-c):PRINTTAB(c,23);$(W%+c);:V
DU31,c,23:UNTILFALSE
 1170 IF(a=32OR(a>47ANDa<58))OR(c>4ANDa
>31ANDa<135ANDa<>127) ?(W%+c)=a:PRINTTA
B(c,23);CHR$a;:PROC_cr:UNTILFALSE
 1180 IFa<>13 ANDa<>144 VDU7
 1190 UNTILa=13 ORa=144
 1200 UNTILa=13
 1210 IF?(W%+5)=146 PROC_del:GOTO1270
 1220 x=VAL$W%:IFx<>i THEN PROC_duP:IFc
=FALSE GOTO980
```

(continued on next page)

(continued from previous page)

```
1230 FORI%=W%+79 TOW%+6 STEP-1
1240   IF?I%=32 ?I%=13 ELSEI%=W%+6
1250   NEXT
1260 t$(i)=$(W%+5)
1270 *FX4,0
1280 ENDPROC
1290
1300 DEFPROC_cr
1310 c=c-(c<78)-(c=3):VDU31,c,23
1320 ENDPROC
1330 DEFPROC_cl
1340 c=c+(c>0)+(c=5):VDU31,c,23
1350 ENDPROC
1360 DEFPROC_del
1370 IFi<n FORI%=i TOn-1:t$(I%)=t$(I%+
1):NEXT ELSEi=n-1
1380 t$(n)="":n=n-1
1390 ENDPROC
1400 DEFPROC_dup
1410 IFx>n+1 ORx<1 ORn>=M%-1 PROC_msg(
"Can't add line "+STR$x+" "):c=FALSE EL
SEc=TRUE:i=x:PROC_add
1420 ENDPROC
1430
1440 DEFPROC_print
1450 CLS:COLOUR0:COLOUR129:PRINT" Outp
ut to Printer "'':COLOUR1:COLOUR128
1460 PRINT"Press ""Y"" to continue, ""
N"" to cancel."'':a$=FN_key("YN"):IFa$=
"N" ENDPROC
1470 b=0:REPEAT:VDUb:INPUT"Left margin
(0-10)",L%:b=7:UNTIL L%>=0 AND L%<11
1475 b=0:REPEAT:VDUb:INPUT"Line spacin
g (1 or 2)",LS%:b=7:UNTIL LS%=1 OR LS%=
2
1480 b=0:REPEAT:VDUb:INPUT"Lines per p
age (40-63)",P%:b=7:UNTIL P%>19 AND P%<
64
1490 Q%=0
1500 VDU2:PRINT:VDU3
1510 PRINT'"Set paper at a new page an
d Press RETURN.":REPEATUNTILGET=13
1520 COLOUR0:COLOUR129:PRINTTAB(0,12);
b$:PRINTTAB(20,12);"PRINTING  --  Press
 SPACE to stop":COLOUR1:COLOUR128:VDU28
,0,24,79,13,12,2
1530 FOR I%=1 TO n:$W%=t$(I%):X%=W%:PR
INTTAB(L%);:Q%=Q%+1:PROC_printline:PRIN
T
1535   IFLS%=2 PRINT:Q%=Q%+1
1540   IF Q%>=P% FOR K%=Q%TO66:VDU10,1
3:NEXT:Q%=0
1550   IFINKEY(-99) I%=n
1560   *FX21,0
1570   NEXT:PRINT''''
1580 VDU3,26,12
1590 ENDPROC
1600
1610 DEFPROC_printline
1620 IF?X%=13 ENDPROC
1630 Y%=LEN($X%)+1:Z%=-1
1640 FORK%=0 TO5
1650   A%=INSTR($X%,sc$(K%)):IFA%>0 AN
DA%<Y% Y%=A%:Z%=K%
1660   NEXT
1670 PRINTLEFT$($X%,Y%-1);
1680 IF Z%=-1 X%=X%+LEN($X%):ENDPROC
1690 ON Z%+1 GOSUB1740,1750,1760,1770,
1820,1830
1700 X%=X%+Y%
1710 PROC_printline
1720 ENDPROC
1730
1740 VDU1,31:RETURN
1750 VDU1,30:RETURN
1760 PRINTLEFT$(b$,10);:RETURN
1770 FOR K%=1 TO LS%:VDU10,13:Q%=Q%+1:
NEXT:IFQ%<P% OR X%?Y%=132 GOTO1800
1780 FOR K%=Q% TO 66:VDU10,13:NEXT:Q%=
0
1790 Y%=Y%-1:REPEAT:Y%=Y%+1:UNTIL X%?Y
%<>131:X%=X%+Y%-1
1800 IF X%?Y%<>131 PRINTSPC(L%);
1810 RETURN
1820 VDU1,18,1,28,1,6,1,129,1,30:RETUR
N
1830 VDU1,18,1,232,1,188,1,202,1,201,1
,194,1,128,1,30:RETURN
1840
1850 DEFPROC_end
1860 CLS:PRINT'"Save text? (Y or N)":a
$=FN_key("YN"):IF a$="Y" PROC_save
1870 PRINT''"Finished with this file?
(Y/N)":a$=FN_key("YN"):IF a$="N" s$="L"
1880 ENDPROC
1890
1900 DEFPROC_defkey
1910 CLS:COLOUR0:COLOUR129:PRINT" Defi
ne Function Keys "'':COLOUR1:COLOUR128
1920 REPEAT
1930   PRINT'"Press 0-9 to define key
f0-f9 (SPACE to end)":b=0:REPEAT:VDUb:a
$=GET$:b=7:UNTILa$=" "OR(a$>="0"ANDa$<=
"9")
1940   IF a$<>" " THEN PRINT"*KEY ";a$
;:$W%="KEY"+a$:INPUT LINE $(W%+4):X%=W%
 MOD 256:Y%=W% DIV 256:CALL&FFF7
1950   UNTILa$=" "
1960 ENDPROC
1970
1980 DEFFN_key(v$)
1990 b=0:REPEAT:VDUb:a$=CHR$(GET AND &
DF):b=7:UNTILINSTR(v$,a$)
2000 =a$
2010
2020 DEFPROC_restart:PROC_init:GOTO60:
ENDPROC
```

(continued from page 118)

number. Allowing the program to supply the next function and line number in this way enables many lines to be added or deleted, or the whole file displayed, without repeated keying of the function code or line number.

When functions C or A are selected the line to be edited is presented at the bottom of the display and the cursor is placed on the first character of the text. The cursor may be moved to left or right using the left and right cursor keys, and text at the cursor position may be overwritten.

The Delete and Copy keys operate somewhat differently from the normal BBC practice. Delete removes the character at the cursor position and shifts succeeding text to the left; Copy inserts a blank at the cursor position and moves succeeding text to the right. This is a simpler method of making small changes to text than the BBC's usual editing method, and is similar to that commonly found on mainframe VDUs. It is much easier to use than to explain. A line may be copied to a new location in the text by overtyping the line number with the new line number.

The function keys are used to provide special functions, in combination with the Ctrl and Shift keys, as shown in table 2. The printer-control codes are those required by the Tandy Line Printer VII; if the printer you are using responds to different codes the function keys must be programmed accordingly. Shift-f2 and Shift-f3 pack several short lines of text into a single line in the text file in order to save space. The shifted function keys are used to control printing; these codes would need modifying for printers other than the Tandy Line Printer VII.

Key	ASCII	Meaning
Ctrl-f0	144	Cancel the changes made to this line so far and restart the Change function
Ctrl-f1	145	Blank from cursor position to end of line
Ctrl-f2	146	Delete this line; sets the first byte in the edit line to a special character which will cause the line to be deleted
Shift-f0	128	Set printer to double-width character mode
Shift-f1	129	Set printer to normal-width character mode
Shift-f2	130	Print 10 blanks at this point
Shift-f3	131	Carriage Return Line Feed at this point
Shift-f4	132	Underline

Table 2.

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• Circle No. 169

Where to draw the line

Boris Allan offers help to frustrated Commodore 64 owners with a series of routines to tap their machines' graphics capabilities.

Listing 1.

```
1000 REM ------------------------------------
1010 REM
1020 REM          GRAPHIC ART FOR THE C64
1030 REM
1040 REM            (C) BORIS ALLAN. 1983
1050 REM
1060 REM ------------------------------------
1070 REM
9997 REM
9998 REM     C64  HIRES : INITIALIZATION
9999 REM
10000 GOSUB 11000 : REM ACTIVATE FUNCTIO
NS
10010 POKE 53265,PEEK(53265) OR 32 : REM
 ENABLE BIT MAP MODE
10020 POKE 53272,(PEEK(53272) AND 240) O
R 8 : REM POINT VIC-II CHIP
10030 FOR I=8192 TO 16191
10040 POKE I,0 : REM CLEAR BIT MAP
10050 NEXT I
10060 FOR I=1024 TO 2023
10070 POKE I,1 : REM WHITE BACK, BLACK P
LOT
10080 NEXT I
10090 RETURN
```

Listing 2.

```
10997 REM
10998 REM          C64 HIRES : FUNCTIONS
10999 REM
11000 DEF FNCO(Z) = 8192 + 320*FNCH(Y) +
 8*FNCH(X) + Y - 8*FNCH(Y)
11010 DEF FNCH(Z) = INT(Z/8) : REM ROW O
R COLUMN NUMBER
11020 DEF FNBI(Z) = 7 + 8*FNCH(Z) - Z :
REM BIT POSITION IN BYTE
11030 RETURN
```

Listing 3.

```
11997 REM
11998 REM       C64  HIRES : LINE CHOICE
11999 REM
12000 IF ABS(LX-NX) >= ABS(LY-NY) THEN G
OSUB 14000 : REM X IS FIXED
12010 IF ABS(LX-NX) < ABS(LY-NY) THEN GO
SUB 15000 : REM Y IS FIXED
12020 RETURN
```

HIGH-RESOLUTION graphics on the Commodore 64 permit a resolution of 320 by 200. The graphics are bit mapped, with each of the 64,000 locations represented by a bit in memory. The bits are grouped into bytes — that is, in eights — so a total of 8,000 bytes or almost 8K is required.

The first problem you encounter when embarking on graphics programming is to find 8K free from Basic in which to store the bit map. One obvious way is to raise the start of Basic to 16348 so that the 8K bit map can be located in the area from 8192 to 16383.

The start of Basic is changed by altering the value of the appropriate pointer, which is held at location 44. Inserting a zero into location 16384 tidies up and checks on the start of Basic programs. You change the start by altering the pointer, resetting the contents of location 16384 to zero. Then enter New to activate all the other pointers which are dependent upon the crucial Start of Basic pointer. The complete sequence is:

```
POKE 44,64:POKE 16384,0:NEW
```

which should be the first action on setting up the system. It should be done before you load any programs or do any ordinary programming.

The pointer to the start of Basic is contained in locations 43 and 44. The start is calculated by:

```
PRINT PEEK(43) + PEEK(44)*256
```

which is normally 2049. The value stored in location 43 is thus 1, and that stored in location 44 is normally 8.

One location before 2049 is 2048 and to

```
PRINT PEEK(2048)
```

is to find the result zero. By setting the value of location 44 to 64, the start of Basic becomes 16385, and the contents of the preceding location, 16384, becomes zero. You are now left with the portion of memory from 2048 to 16383 in which to store your bit map.

Bit map

To tell the Commodore 64 that you want to store the bit map from 8192 onwards you must address location 53272, used by the Vic memory-control register. The *Programmer's Reference Guide* published by Commodore discusses the location of character memory on page 104.

The bit map is nothing more than a

collection of characters, each of eight bytes. The bit map coincides with memory available for user-defined characters, and the full screen is made up of 40 columns and 25 rows of the eight-pixel by eight-pixel characters. If bits 3 to 1 of location 53272 are set to 100, then character memory is taken to start at 8192. To make this change enter

POKE 53272, (PEEK(53272 AND 240) OR 8)

To switch on the bit map mode, set bit 5 of location 53265 to 1. Location 53265 is the Vic control register, so you set bit 5 to 1 by

POKE 53265, PEEK(53265) OR 2^5

When you have switched into bit-map mode you have to set all bytes in the bit map to zero so as to clear the decks for plotting. You also have to set the colours needed for plotting. The colour for the bit map comes from the screen memory, normally stored from locations 1024 to 2023, and not the colour memory. The lower four bits of the byte corresponding to a character in screen memory set the colour of the high-resolution background. The upper four bits set the colour of the plotted pixels.

Colours

The colours are those normally associated with the Commodore 64. They range from 0 for black to 15 for grey 3 and are set by each 64-pixel character location. Pixels can only be coloured in eight-by-eight blocks; they cannot be individually coloured.

Subroutine 1000 sets up the high-resolution graphics system, once the Basic area has been set to start at 16385. The routine is more or less self-explanatory, apart from the call to functions in the subroutine at line 11000. It plots black pixels against a white background. The number Poked into locations in screen memory is 1, or binary 00000001; if you prefer a black background and white pixels Poke 16, or 00010000 in binary.

The three functions necessary for plotting in high resolution are collected together in subroutine 11000. They are called as part of the initialisation subroutine because all functions have to be defined explicitly before they can be used.

FNCH(Z) is used to work out the row and column of the character which corresponds to specified co-ordinates. The X co-ordinates range from 0 on the left to 319 on the right. If the X co-ordinate of a particular pixel is 115 this corresponds to a character in the column given by

INT(115/8)

which is column 14. The Y co-ordinates run from 0 at the top of the screen to 199 at the bottom. So 89 corresponds to a character in the row given by

INT(89/8)

which is row 11. Both columns and rows are numbered from zero.

There are 320 bytes per row, and eight bytes per column along the row. FNCO(Z) calculates the byte number/location for the

(continued on next page)

Listing 4.

```
13997 REM
13998 REM  C64 HIRES : X COORD IS FIXED
13999 REM
14000 S = 0 : IF LX-NX <> 0 THEN S = (LY
-NY)/(LX-NX) : REM GRADIENT
14010 FOR X=INT(LX+.5) TO INT(NX+.5) STE
P SGN(NX-LX) : REM X IS NOW FIXED
14020 Y = INT((X-LX)*S+.5+LY) : REM DERI
VE Y VALUE
14030 P = FNCO(0) : IF P>8191 AND P<1619
2 THEN POKE P,PEEK(P) OR 2^FNBI(X)
14035 REM POKES 1 INTO BIT FNBI(X) AT AD
MISSABLE LOCATION P
14040 NEXT X
14050 RETURN
```

Listing 5.

```
14997 REM
14998 REM  C64 HIRES : Y COORD IS FIXED

14999 REM
15000 S = 0 : IF LY-NY <> 0 THEN S = (LX
-NX)/(LY-NY)
15010 FOR Y=INT((Y-LY)+.5) TO INT(NY+.5)
 STEP SGN(NY-LY)
15020 X = INT((Y-LY)*S+LX)
15030 P = FNCO(P) : IF P>8191 AND P<1619
2 THEN POKE P,PEEK(P) OR 2^FNBI(X)
15040 NEXT Y
15050 RETURN
```

Listing 6.

```
100 REM
110 REM            C64 HIRES : EXAMPLE I
120 REM
130 INPUT "LX,LY"; LX,LY : INPUT "NX,NY"
; NX,NY : REM COORDINATES
140 GOSUB 10000 : REM INITIALIZE
150 GOSUB 12000 : REM DRAW LINE
160 GOTO 160
170 END
```

Listing 7.

```
200 REM
210 REM            C64 HIRES : EXAMPLE II
220 REM
230 GOSUB 10000 : REM INITIALIZE
240 LX = 0 : LY = 0 : REM LAST COORDINAT
ES
250 FOR NX=20 TO 300 STEP 20 : REM SET N
X COORDINATE
260 NY = NX*NX/300 : REM CALCULATE NEW N
Y COORDINATE
270 GOSUB 12000 : REM DRAW LINE
280 LX = NX : LY = NY : REM RESET LAST C
OORDINATES
290 NEXT NX
300 GOTO 300
310 END
```

(continued from previous page)
co-ordinates X and Y, starting from memory location 8192. FNCH(Y) gives the number of the character row which contains the co-ordinate Y, which is multiplied by 320 to give the number of bytes before the present row.

FNCH(X) gives the number of the character column which contains the co-ordinate X. This column is then multiplied by 8 to determines the number of bytes in that row prior to that column. The final part of that line

```
Y-8*INT(Y)
```

works out how many bytes through the character is that Y co-ordinate.

The final function, FNBI(Z), is used to find the bit position within a byte in the character. The left-most bit is numbered 7 and the right-most is numbered zero, which is in the opposite sense to the co-ordinates. Just as the byte position in FNCO is calculated by

```
Y-8*FNCH(Y)
```

so the bit position is worked out by

```
X-8*FNCH(X)
```

and then subtracting that value from 7 to give

```
7+8*FNCH(X)-X
```

The most important decision you have to make when drawing lines is whether to fix the X co-ordinates or the Y co-ordinates. In the Line choice subroutine at 12000 the system expects that the line starts at LX, LY and extends to NX, NY. The first of the two If statements is activated when the difference between co-ordinates in the X direction is greater than or equal to the difference in the Y direction, otherwise the second If statement is activated. The first If makes a call to subroutine 14000, and the second calls subroutine 15000. Both subroutines are similar in operation, so to describe one effectively describes them both. The difference comes from whether the X axis or the Y axis is accentuated.

Gradient

Subroutine 14000 starts by setting the gradient S to zero. Subroutine 14000 concentrates on the X axis, so the first step is to find whether LX is equal to NX. If not, the beginning and the end of the line are at different points, and the next step is to calculate the gradient. If LX is equal to NX this step would involve division by 0.

The subroutine takes values of X from the rounded value of LX to the rounded value of NX in steps of 1, 0, or −1 depending upon the sign of the difference between NX and LX. For each value of X, it calculates the equivalent rounded value of Y, and then calls function FNCO to find the correct location number P. If P is within the limits 8191 and 16192 then a value is Poked into location P.

The value Poked is the already existing value in that location, Ored with 2^FNBI(X). Since FNBI(X) gives the number of the bit in the byte at location P, Oring with 2^FNBI(X) sets that bit number to one and leaves the other bits unchanged. Drawing a line therefore you only need to call Gosub 12000, with values set for LX,LY and NX,NY. Nothing else is needed.

The program in listing 6 draws one straight line between specified co-ordinates, and is a useful way of checking on the workings of the system as a whole. The final line puts the machine into a waiting state without putting any prompt up on the screen which messes up screen memory.

You input the co-ordinates, then initialise the system by a call to Gosub 10000 and draw the line by Gosub 12000. This program is good for experimenting with reasonable and unreasonable co-ordinates to see what happens.

The program in listing 7 draws a parabola, though with modification other functions can be used. It starts at the origin, and the value of NX is increased from 20 to 300 in steps of 20. The corresponding value of NY calculated by

```
NX*NX/300
```

A line is drawn to the new co-ordinates NX, NY by Gosub 12000.

The starting co-ordinates for the next line are made equal to the present values of NX and NY, and new values for NX and NY are calculated on the next step of the loop. The parabola is drawn as a succession of straight lines, without calculating the exact co-ordinate for every value of X from 0 to 319.

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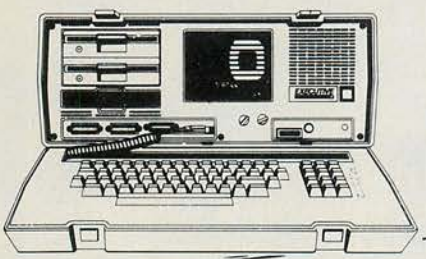

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Battery portables

Ian Stobie's selection of the machines which provide computing power anywhere you need it.

TRULY PORTABLE battery-powered computers form one of the most rapidly growing sectors in the computer market. These machines now have enough processing power to do a real job of work, while their independence from the mains supply lets them get out to wherever the work may be.

For this survey we are defining the true portable computer to be battery powered with at least one working day's endurance, with a full-size keyboard and a built-in display of at least 80 characters. A weight of 15lb. would be a reasonable maximum for ready portability, but in practice most of the machines included here weigh far less. As a rule heavy machines are not battery powered.

The distinction between true portables and Osborne-style transportables therefore almost reduces to power source, while the distinction with pocketables is given by keyboard size. We have excluded portable terminals as they are not programmable as stand-alone machines.

The computers in this survey are finding a very wide variety of uses. Rugged machines like the Fieldwork Fifty and Husky are collecting data and solving problems down mines and, literally, in the field. Lower-cost machines like the Epson and Tandy models have proved popular for assembling text; a number of firms are now able to transfer it from there directly into typesetting machines. Perhaps more typical is the use of this kind of machine by sales reps to collect client details and give an instant quote.

More surprisingly, many of these portables are being used attached via a power adaptor to the mains, for instance set on the dispensing counter at the back of a chemist's shop. What machines like the Epson HX-20 provide is a complete data-processing system in a neat and cheap package. They may offer all that is required for a simple label-printing and stocktaking system. What is more, such a system brings even greater benefits when attached via an acoustic modem to the phone line, and thence to the wholesaler's mainframe.

Our top 10 selection appears on the next two pages. Contact addresses for manufacturers and U.K. distributors are given in the panel below.

Suppliers

Casio FP-200: Casio Electronics Co. Ltd, Unit 6, 1,000 North Circular Road, London NW2 7JD. Telephone: 01-450 9131

Epson HX-20: Epson U.K. Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 5UH. Telephone. 01-902 8892

Fieldwork Fifty: Immediate Business Systems plc, 3 Clarendon Drive, Wymbush, Milton Keynes, Buckinghamshire MK8 8DA. Telephone: (0908) 568192

Gavilan: Adam Computer Systems, Ripon Way, Ripon Road, Harrogate, North Yorkshire HG1 2AU. Telephone: (0423) 501151

Husky: Husky Computers Ltd, PO Box 135, Foleshill Road, Coventry CV6 5RW. Telephone: (0203) 668181

Olivetti: British Olivetti Ltd, PO Box 89, 86-88 Upper Richmond Road, London SW15 2UR. Telephone: 01-785 6666

NEC PC-8201: NEC Business Systems (Europe) Ltd, NEC House, 164-166 Drummond Street, London NW1 3HP. Telephone: 01-388 6100

Sharp PC-5000: Sharp Electronics (U.K.) Ltd, Sharp House, Thorp Road, Manchester M10 9BE. Telephone: 061-205 2333

Tandy Model 100: Tandy Corporation, Tameway Tower, Bridge Street, Walsall, West Midlands WS1 1LA. Telephone: (0922) 648181

Workslate: Convergent Technologies, 38-40 Sycamore Road, Amersham, Buckinghamshire HP6 5DR. Telephone: (02403) 28515

An Epson HX-20 on site, running estate agent's software from Sydney Development Co.

CASIO FP-200 £299

A4-sized portable with spreadsheet software in ROM. Weighs 3lb. and has an eight-line by 20-character liquid-crystal display. Full-size keyboard is acceptable but not of Tandy or Epson quality. The FP-200 is built around the eight-bit 80C85 processor and comes with 16K of RAM expandable to 32K, and 32K of ROM. The ROM contains a spreadsheet program and a Casio Basic. Data can be exchanged with other Casio machines through cassette interface. A small range of Casio software is available on cassette. Mains-powered four-colour printer/plotter costs around £170; other printers connect to parallel printer port. Upgraded machine with 16K RAM and a more advanced spreadsheet program in ROM costs £399.

For. Price. Built-in spreadsheet.

Against. Keyboard not really WP quality. Not much software.

EPSON HX-20 £402

Well established A4-sized portable with best range of software of the under £1,000 portables. Weighs 4lb. and has a four-line by 20-character liquid-crystal display, a good-quality full-size keyboard and a built-in 24-column printer. Microcassette drive fits next to display and is well worth the extra £75 for data and program storage. Built around the eight-bit 6301 processor with 16K of RAM, expandable to 48K with clip-on expansion unit. The 32K of ROM holds Microsoft-written OS and Basic, but the software is quite different to the NEC/Olivetti/Tandy machines. Lots of optional hardware add-ons from independent third-party suppliers, including full-size display and modems.

For. Good software base. Microcassette option. Well established.

Against. Screen too small by current standards.

FIELDWORK FIFTY £2,236

Tough, light portable that runs CP/M software and uses bubble memory. Intended for use in harsh environments and designed to keep operating in temperatures from −30°C to +70°C; it is also waterproof, and it floats. Weighs under 4lb. and has a two-line by 40-character liquid-crystal display. Full-size keyboard available in QWERTY, ABC or AZERTY layouts. Built around a CMOS variant of the eight-bit Z-80 and comes with 32K of RAM. The standard 64K of bubble memory is expandable to 256K; it functions like a disc drive but is tougher. An extra £250 buys Microsoft Basic and CP/M 2.2 capability. Full RS-232C is fitted and various hardware add-ons are available.

For. Very tough. Runs CP/M software.

Against. Toughness dictates high price and small display.

GAVILAN £2,695

16-bit 8088-based portable with MS-DOS operating system and advanced touch-screen user interface. Base model Gavilan SC has eight-line by 80-column liquid-crystal display and comes with MS-DOS. More expensive 16-line Gavilan costs £3,495. Packages available at extra cost include WordStar and Supercalc-2. Runs Gavilan's own-brand OS as well a MS-DOS, and comes with integrated word processing, spreadsheet and communications software. Both models weigh about 9lb. and have full-size QWERTY keyboard, 64K of RAM expandable to 288K and a built-in 3.5in. microfloppy drive. Clip-on battery-powered A4 printer available. Plug-in modem awaiting BT approval. Gavilan's U.K. arrival expected March 1984.

For. Large screen. Neat design. Runs MS-DOS software.

Against. Price. Not yet here.

HUSKY £1,784

Tough portable that runs CP/M software. Intended for use in harsh environments, using large amounts of battery-backed CMOS RAM for storing data and programs. Weighs just over 4lb. and has a four-line by 32-character LCD screen. Flat, waterproof, membrane-covered keyboard is about standard size but has unusual layout, with numerics easier to generate than alphabet. Built around a CMOS version of the eight-bit Z-80 processor. Comes with 32K to 144K of RAM and a full Basic. Runs CP/M 2.2 programs. Fitted with full RS-232; IBM 2780 protocol option is available for Husky-to-mainframe communications.

For. Very tough. Runs CP/M software.

Against. Non-standard keyboard. Gets expensive as you expand memory.

Portables: top 10

NEC PC-8201 £475

A4-sized portable with Microsoft-written software in ROM. Weighs under 4lb. and has an eight-line by 40-character liquid-crystal display and a full-size keyboard. Built around the eight-bit 80C85 and comes with 32K of ROM and 16K of RAM, expandable to 96K. The ROM includes Microsoft's text-editing program and a full Basic, which is slightly better than the Olivetti's. The PC-8201 is built in Japan for NEC by Kyocera, which also makes the similar Olivetti and Tandy machines surveyed here. The NEC version starts with more RAM and can be expanded further. You can get exchangeable battery-backed RAM cartridges for program and data storage. Equipped with cassette port and full RS-232 interface.

For. Good memory expansion. Good Basic. Nice keyboard.

Against. Newer and rarer than Tandy variant so less software.

OLIVETTI M-10 £430

A4-sized portable with Microsoft-written software in ROM. Weighs under 4lb. and has an eight-line by 40-character liquid-crystal display which pops up. Full-size keyboard. Built in Japan by Kyocera around eight-bit 80C85 processor. Base model comes with 8K of RAM, expandable to 32K. The 32K ROM contans Microsoft's text editor, a good Basic and a simple address-list and appointments program. Four-pen printer/plotter and battery-powered £250 BT-approved acoustic coupler available. RS-232 serial port and cassette interface fitted as standard.

For. Good Basic. Nice keyboard. Olivetti name.

Against. Newer than Tandy. Less memory than NEC.

SHARP PC-5000 £1,195

16-bit 8088 based portable with MS-DOS operating system and optional bubble memory. Weighs 11lb.; has eight-line by 80-character liquid-crystal display and full-size QWERTY keyboard. Standard model comes with 128K of RAM expandable to 256K. MS-DOS 2 and GWBasic are contained in ROM. Optional 128K plug-in bubble-memory module costs £164 and functions like a more robust floppy disc. Supercalc and other MS-DOS software available on bubble. Optional clip-on battery-powered A4 printer. External floppy promised, plug-in modem awaiting BT approval. Similar to Gavilan but with bubble memory instead of microfloppy for mobile use.

For. Neat design. Keen price. Runs MS-DOS software. Bubble-memory option.

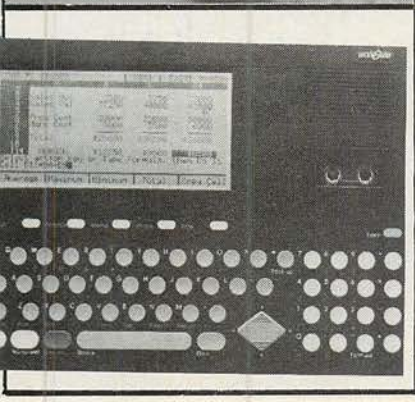
Against. Software comes on bubble which may restrict choice.

TANDY 100 £424

Well established variant of the Kyocera A4-sized portable, with more available software than the NEC or Olivetti versions. Weighs under 4lb. and has an eight-line by 40-character liquid-crystal display. Full-size keybord has the nicest typing feel of the Kyocera machines. Eight-bit 80C85 processor and 8K of RAM, expandable to 32K; 32K of ROM with similar Microsoft-written contents to the Olivetti's. Fitted with RS-232 serial port and cassette interface; mains-powered four-pen printer/plotter and acoustic coupler are options. The Tandy was the first of the three Kyocera machines on the market, and has been very successful in U.S. benefiting its software base.

For. Good Basic. Excellent keyboard. Reasonable software base.

Against. Less memory than NEC. Less scope for memory expansion.



WORKSLATE around £750

Small portable with spreadsheet in ROM, aimed at executives. Weighs 3lb. and has a 16-line by 46-character liquid-crystal display. Keyboard slightly smaller than full-size. Built around a Hitachi eight-bit CMOS processor with 16K of RAM, and 64K of RM with diary/alarm program. The spreadsheet software has models already set up for common business tasks. Built-in microcassette can be used for voice recordings. Range of software available on microcassettes in U.S. Battery-powered four-colour printer/plotter uses 4.5in. paper roll. Built-in plug-in modem in U.S. model. U.K. distribution still being set up.

For. Compact. Built-in software seems relatively straightforward.

Against. Non-standard operating system. Small keyboard. Not yet here.

Xerox's ivory tower

Christopher Roper talks to the key figures at Xerox's Parc about their long-term plans.

THE FIRST suprise when you visit Xerox's Palo Alto Research Center, Parc, is that the front door is on the third floor. The terraced building is draped over the side of Coyote Hill, its windows facing south and east over Silicon Valley, its back to San Francisco, which lies 40 miles away to the north.

Since it opened its doors in 1970, Parc has been a place of pilgrimage for computer scientists from all over the world.

The Apple Lisa, introduced with great fanfares in 1982, is a dead ringer for the Xerox Alto, which has been widely used inside the company, but never marketed, since 1972. Bit-mapped screens, optical disc storage, the languages Mesa and Smalltalk, and the Ethernet local area network are some of Parc's firsts.

So why has Xerox not sold more computers? Indeed, what relation is there between all the activity in Palo Alto and the company's business? Robert Taylor, the head of Parc's computer science division from its inception until he left in September, says that Xerox finds it hard to answer these questions.

Computer science made Parc famous, but never accounted for more than 20 percent of the laboratory's budget or resources. Part of the reason for Xerox's failure to capitalise on Parc's undoubted successes can be found in its unhappy experiences as a computer manufaturer in the early 1970s.

High flyer

In 1968 Xerox acquired Scientific Data Systems, a high-flying computer manufacturer at the time of the merger, at a cost of $918 million worth of Xerox shares. Seven years later, after absorbing losses of more than $250 million, Xerox announced it was leaving the mainframe computer business.

Senior Xerox executives still wince at the memory, and while they were prepared to market the Star as a personal executive work station, it was not described as a computer. The trauma of the SDS collapse meant that Xerox did not build on the research being done at Parc in its early years. Even though 100 Alto machines were installed in the White House and are still in daily use, it was not regarded as a suitable product for the company in the Xerox executive suite.

Today, Xerox has a new chief executive, and there is some hope among research workers at Parc that their computers will soon make a direct impact on the market place. Two factors combine to give Xerox a second chance. The first is that very large scale integration, VLSI, means that the real cost of Xerox's advanced personal computers will drop to a level which is comparable to that of competing machines. The second is that users are beginning to demand higher software standards and improved networking facilities from their personal computers.

No company, and that includes IBM, is better placed than Xerox to provide the next generation of personal computers. While Commodore and Apple derived their ideas for personal computers from the sudden availability of cheap microprocessors, Alan Kay at Parc was dreaming up a personal computer which was independent of the hardware constraints of the time.

His notion of a hand-held Dynabook with a high-resolution screen, 2Mbyte to 3Mbyte of internal memory, and simple access to communications seemed quite fanciful when he first propounded it 15 years ago. The engineers at Parc accepted the challenge and the Alto's first name was the interim Dynabook. The latest portable computers, like the Tandy 100 and the Grid Compass — designed by a Parc alumnus —

Parc and the future

One of the major bottlenecks for Xerox, wanting to sell more advanced systems, and for anyone wishing to apply expert systems to their current problems, is an acute shortage of qualified personnel.

Researchers at Parc are looking for ways to enlarge the neck of the bottle by increasing the impact and scale of knowledge engineering by simplifying the methods of knowledge programming and making them more widely accessible. In pursuit of this objective, they have developed an experimental knowledge programming system called Loops. Unlike other systems, which are based on a single programming language, Loops borrows widely from different methods and traditions of abstract knowledge representation. In order to test the validity of Loops, the research team at Parc developed Truckin, which is a board game with road|stops. The players drive around, buying and selling commodities. Their job is to plan a route and make a profit. There are various hazards along the way, such as places where goods and profits can be lost. None of this sounds very different from other role-playing simulation games which use a computer to keep track of the consequences of different moves, and feed the players randomised hazards. There is one twist which sets Trucking apart: the players are computer programs constructed by the human participants. The task is to build the program which plays the best, by reaching Alice's Restaurant with the most cash.

The game has been refined into a three-day course which is being distributed by Xerox and is available to any institution with a Xerox computer and Interlisp-D. This may seem remote to *Practical Computing* readers, but soon such products may be soon sitting on our desks.

look more and more like Kay's original vision.

Software has always been developed in conjunction with hardware at Parc, and this has sometimes created headaches for would-be imitators. The Mesa systems programming language, developed at Parc and the source of several of Niklaus Wirth's ideas for Modula-2, is based on an exceptionally economical instruction set.

When Larry Tesler of Apple sought to achieve the same effects on the Lisa, based on the 68000 processor, he found that he needed far more memory than he originally estimated. This greatly increased the cost of Lisa. The high-resolution screen, with multiple windows, the icons, and the enhanced Pascal programming environment are all characteristic of Parc. This is not surprising as Tesler is another migrant from Xerox to the competition.

The new generation of Xerox computers, the 1100 series, descendants of the old Alto design, is only just coming on to the market, costing upwards of $30,000 per system. They are more expensive than other personal computers, but they are also cheaper than some minicomputers with comparable capabilities. Universities wanting to do advanced artificial Intelligence work with Lisp, for example, can now buy a Xerox system for less than half the price of a machine from Symbolics Inc.

The 1100 and the smaller 1108 provide the best models I have seen of what an ordinary personal computer, costing no more than an IBM PC does today, should look like in four or five years time, with software to match the most demanding user's needs. However, it is still not clear that it will be Xerox which will provide the next generation of personal computers. The departure of Xerox research workers to rival companies prompted an article in *Fortune* magazine last September on "The lab which got away". There is talent still remaining at Parc, and as Lisa shows, it is one thing to walk out of the door with great ideas and another to make them work.

Xerox is not indifferent to attempts to emulate their achievements — a substantial corner of Parc is occupied by patent and copyright lawyers beavering away to protect the company's intellectual property. The law seems to say that while imitation is the sincerest form of flattery, duplication is theft.

In one important respect, Xerox has refused to follow the wishes and advice of its research workers. Smalltalk and Mesa have remained firmly in-house, unavailable on anything other than a Xerox machine. This policy was maintained throughout the 1970s despite enormous public interest in Smalltalk, and the fact that Mesa represented the state of the art in systems programming languages.

Exclusive

In fact, Mesa today can do almost everything that is claimed for Ada. But Xerox believed that the language should remain exclusive to its machines, which were not for sale at that time. This policy is now being re-evaluated: Smalltalk is already available under licence to other manufacturers and Mesa will be shortly. The third Xerox language, Interlisp-D, is available only on the Xerox 1100 series.

Bob Taylor says firmly that senior Xerox management never understood computers, and may still not. He was able to assemble the most talented computer research team ever gathered under one roof because, in

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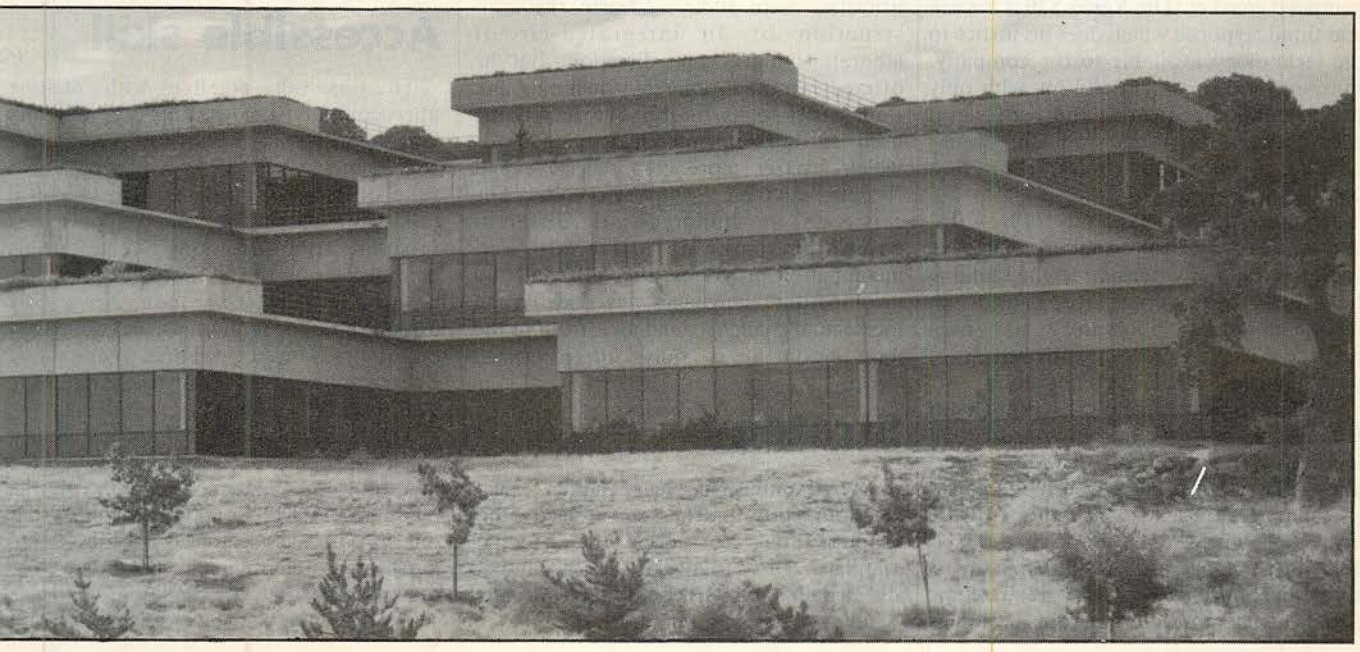

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the late 1960s, he was running the computer science division of the Defense Department's Advanced Research Projects Agency. In this capacity, he had been responsible for setting up Arpanet, one of the world's first computer networks, and for funding the first computer science departments in American universities. By the time he went to Xerox in 1970, Taylor believed that with the cost of integrated circuits dropping and their reliability improving rapidly it was no longer useful to pursue the idea of time-sharing.

The new concept, which had developed among the Arpanet community and dominated thinking at Xerox Parc from the beginning, was distributed computing. It implies computing power and memory distributed through a networked system of personal computers, equally available to all users, and without any central mainframe being used to control the operations of the network.

The vision cannot easily be faulted. No one who has ever used a network wants to go back to time-sharing or to a stand-alone personal computer. But the vision was wrong in one important respect — timing. When personal computing began to take off in the mid-1970s, the boom built up around stand-alone systems.

Smuggled Apples

The multi-national corporations, which might have bought Xerox's networked systems, ignored personal computers until their own executives began to smuggle in Apples and Pets through the back door. Data-processing departments resisted the idea of personal computing until the last minute, and IBM did not consider building a personal computer until 1980, and even then did not foresee the dramatic impact of the PC.

Xerox has been slower than IBM to respond to the rapidly changing personal-computer market. The Xerox 820 is a weak and timid response which does no justice to the technology available to the company. Furthermore, it is a closed box, with only proprietary hardware and software, even though the users want the widest possible freedom to choose their own configurations.

Despite defections and other discouragements, Xerox is still committed to Parc. A major extension to the building has just been completed, and an integrated-circuit laboaratory has been built next door, a combined investment of more than $50 million in plant alone.

William Spencer, who was brought in from Bell Labs to run the integrated-circuit laboratory, now controls the whole operation. The rise of Spencer is seen by some as the end of an era in which the software drove the hardware at Parc, but this is denied by management. VLSI, they say, is where hardware and software really come together. The absolute prerequisite now is for overall control to be in the hands of someone who understands VLSI.

A senior Parc man a drew a parallel with Intel, a company which started just before Parc opened. In 1980, the year in which Xerox decided it could no longer buy chips off the shelf, Intel decided it could no longer ignore high-level software considerations.

It is easy to underestimate Xerox's presence in the computer business, partly because several of its subsidiary companies still operate under their original names. For example, Diablo produced the first daisywheel printer and is now a Xerox company; one its inventors has become a member of the Parc staff, working on the next generation of printer products.

Shugart is another Xerox company and recently announced an optical non-erasable storage disc with a capacity of 1,000 Mbyte. In quantities of 250, the new drive will cost a modest $6,000. The development of the optical drive was for years the most expensive project at Parc, and many believed it would never result in a saleable product.

On a recent visit to Parc, I asked Dr Harold Hall what Xerox's strategic priorities were today. Clearly the construction of an integrated-circuit laboratory marks one direction, but he offered two other pointers which may link Parc's past to its future. The first is the need to develop interchange standards which are far more comprehensive and flexible than the present ASCII codes. The existence of hundreds of different computers running different and incompatible programs, all in different and incompatible languages, is clearly an intellectual challenge, and an affront to the Parc vision of a fully interconnected world.

Strategy

Xerox published the Ethernet specifications early and has encouraged other manufacturers to adopt the Ethernet standard. DEC followed this lead and so did Britain's ICL. IBM has not yet decided what to do about LANs, but its specifications are unlikely to be very different from Ethernet.

Ethernet, however, is a hardware standard, and the most urgent need now is for software interchange standards covering bit-mapped screens, graphics and digitised voice messages. Xerox has not published its proposals, but is likely to do so over the next five years, and this is likely to be a hotly contested topic, given the commercial benefits to the companies whose standards are adopted.

Hall went on to say that he saw experimental programming languages standing in the same relationship to the world of commercial computing today as distributed computing did in 1970. Conventional wisdom holds that the world of computer users will continue to be divided into a minority of professional systems analysts and programmers, and a majority of passive consumers of applications programs. The developers of experimental programming languages, including the folk at Parc, believe that everyone who uses a computer should ultimately have access to its full power through the ability to program their own applications.

Accessible skill

That is not possible with existing microcomputers and existing programming languages. It is a difficult and time-consuming task to write a program or a suite of programs which perform useful tasks. At the same time, applications programs are often not as simple, flexible or universal as their vendors claim. They are merely the best we have. Xerox now offers three programming environments on its advanced personal computers. Programming is still not an easily accessible skill, but that is the goal.

The frustration of the Parc researchers when their ideas remain locked in the laboratory is understandable. Yet the computing world should be thankful that one corporate laboratory is working with a perspective measured in decades rather than months, and with the resources to give substance to its view of the future.

The 1100 Series

Xerox's 1100 series of personal computers all descend from the Alto, and represent the culmination of 10 years of integrated hardware and software design. The smallest is the 1108, which comes with up to 1.5Mbyte of main memory, and either 10Mbyte or 29Mbyte of disc memory. The 1100 is very similar to the 1108, but has a larger main memory, expandable to 2Mbyte.

The 1132, known as the Dorado, is described by Xerox as the most powerful personal computer ever produced, with its main memory expandable to 8Mbyte. The Dorado is not yet available in production quantities. Those sold so far, mainly to universities, were hand-built at Parc. It is hot and noisy in its present form in comparison to the 1100.

A recent article on AI complained that the Xerox 1108 had "rather small address space". The 1100 series are not based on single-chip processors; they use boards developed at Xerox from standard components, and the price is expected to drop dramatically with VLSI.

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Plenty of choice

Atari owners still have the widest range of games to choose from. Jack Schofield makes another selection from the newer offerings.

WITH MOST MICROS, reviewing games is not as much fun as it sounds. Usually some 30 to 40 tapes have to be loaded to find half a dozen even worth a mention. With the Atari, however, there is an embarrassment of riches. Games that would be on the top rung for most machines may hardly get played. As 40 of the current top 50 games in the U.S. — according to the leading distributor, Softsel — run on the Atari, the reviewer is spoiled for choice.

What is unusual about the latest crop of Atari games is that several originate in the U.K., though naturally they are designed for the American market. The firms involved are Parker, Thorn-EMI and Atari International, based in Slough, which has published a British game on tape as part of Atari's main line of programs.

As with the most recent collection of Spectrum games, reviewed in our November 1983 issue, the new offerings also have a strong three-dimensional content. However, unlike most of the Spectrum ones, nearly all the Atari programs are excellent games.

Zaxxon/Blue Max

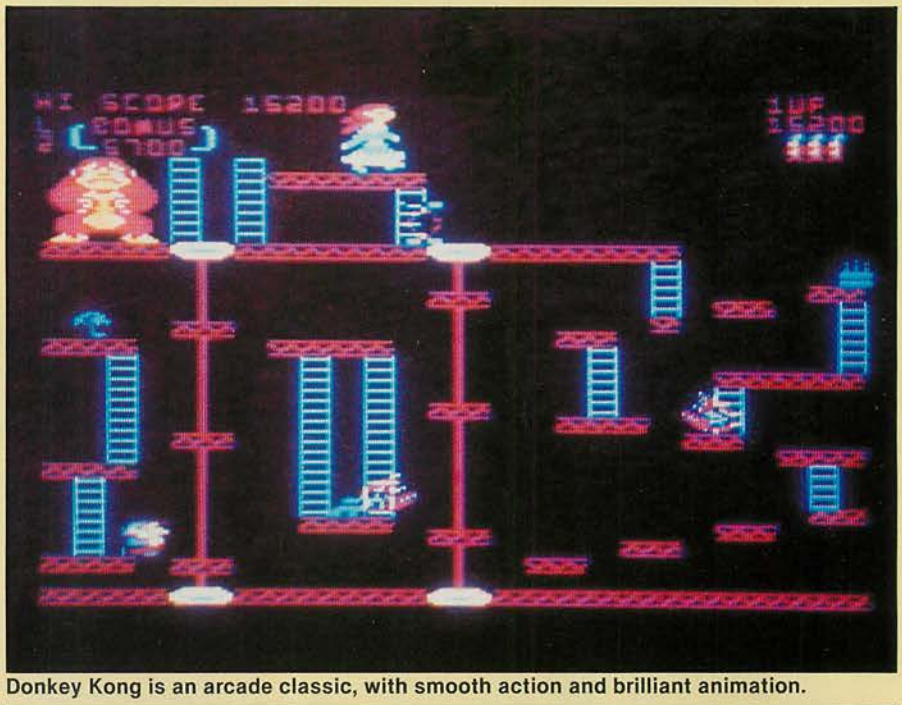
Both Zaxxon from Datasoft and Blue Max from Synapse are three-dimensional flying shoot-em-up games with landscapes that scroll one pixel at a time. In each case you fly a bottom left/top right diagonal, and judge altitude partly by the shadow of your plane travelling across the landscape. In both games you have to strafe the enemy on the ground, and fight enemy planes in the air.

Zaxxon is already well known from the arcades. The home-computer version from Datasoft is still number 2 on the Softsel chart over a year after its American launch. Last year it was voted the Game of the Year and won various awards. Zaxxon's only problem is that Blue Max is even better.

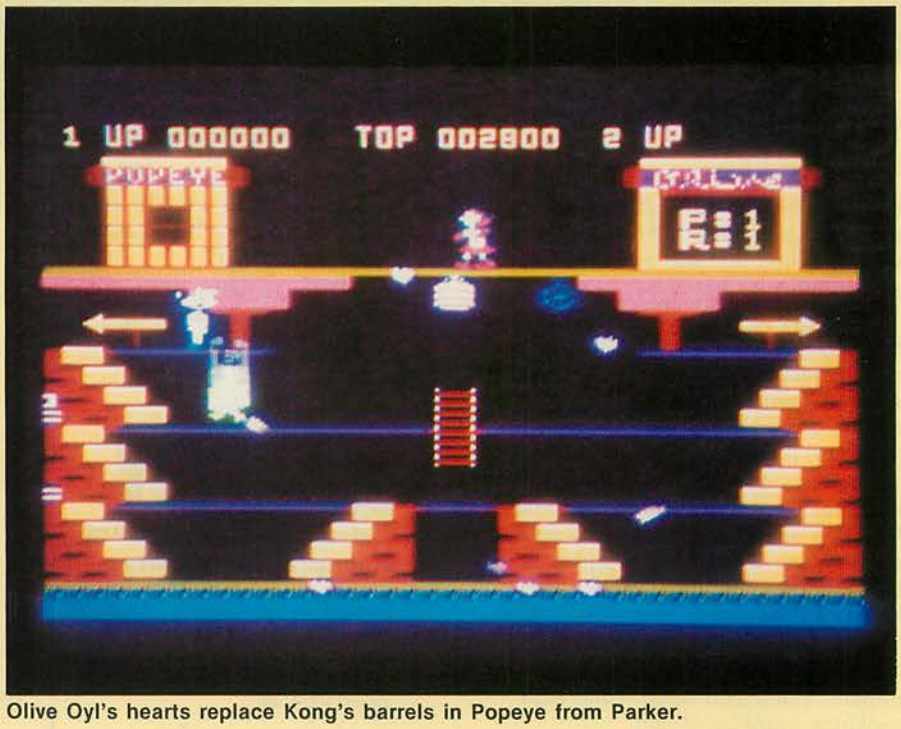
In Zaxxon you fly a space fighter — though it looks rather like an old Vulcan bomber — over a modernistic enemy base. You blow up fuel tanks and enemy planes while threading through parapets and force fields. In the end, if you are very good, you destroy a deadly robot. It is all done mainly in blues and whites with very detailed graphics — though not as good as the arcade ones. Sound effects are whooshes and crumps.

In Blue Max you are Max Chatsworth, pilot of a rickety World War I biplane. The sortie begins with a rousing rendition of *Rule Britannia.* You fly along a river, then a road, until after several hours practising take-offs and landings you eventually reach a city base. On the way you strafe or bomb tanks, buildings, boats, bridges, passing vehicles and other targets.

Blue Max has several improvements over Zaxxon. First, the area covered is enormous, unlike the restricted landscape of Zaxxon. In some respects Blue Max gives a strong feeling of flight simulation. Second, there are enemy planes which come from in front and behind, each with its own



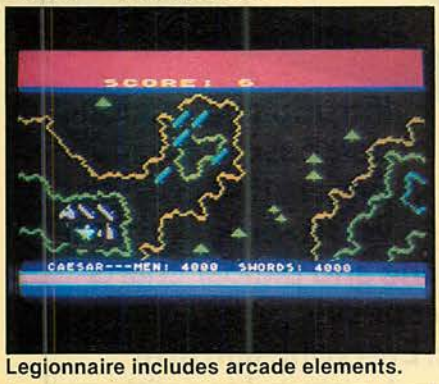
Donkey Kong is an arcade classic, with smooth action and brilliant animation.



Olive Oyl's hearts replace Kong's barrels in Popeye from Parker.

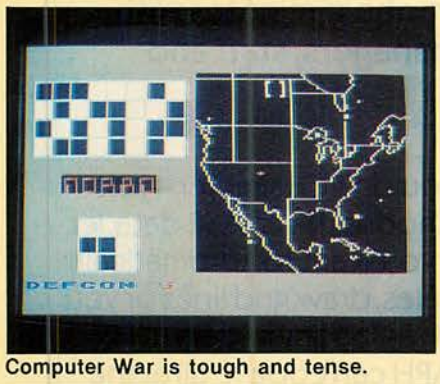
Zaxxon — still at number 2.

Bob Palin's brilliant Blue Max.



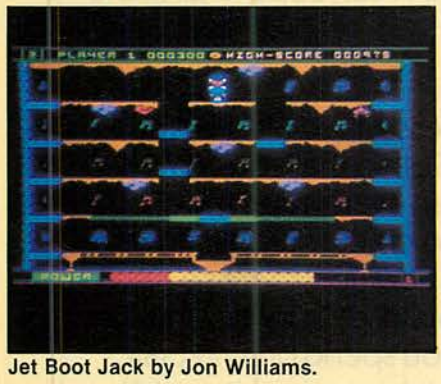
Legionnaire includes arcade elements.

Eastern Front — now better than ever.

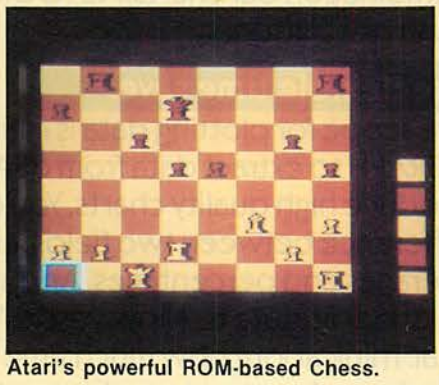


Computer War is tough and tense.

Pole Position — strictly for drivers.



Jet Boot Jack by Jon Williams.



Atari's powerful ROM-based Chess.

Game	Publisher	Format	Price	Rating
Blue Max	Synapse	Cassette or disc	£27.75	18/20
Chess	Parker	ROM cartridge	TBA	17/20
Computer War	Thorn-EMI	ROM cartridge	£29.95	16/20
Donkey Kong	Atari	ROM cartridge	£29.99	17/20
Eastern Front	Atari	ROM cartridge	£29.99	19/20
Jet Boot Jack	English Software	Cassette	£14.95	14/20
Leggit	Imagine	Cassette	£5.50	10/20
Legionnaire	Avalon Hill	Disc	£29.30	15/20
The Lone Raider	Atari	Cassette	£14.99	14/20
Pole Position	Atari	ROM cartridge	£29.99	16/20
Popeye	Parker	ROM cartridge	£34.50	17/20
Zaxxon	Datasoft	Cassette or disc	£33.00	17/20

shadow on the landscape. Shooting them down is great. By contrast, the enemy planes in Zaxxon come out of a safe, solid black background.

Blue Max also offers more variety in that you can bomb targets as well as firing at them. This brings a wider variety of semi-realistic sound effects, too. Yet in spite of all this, the game is very easy to play, because everything is controlled from the joystick. At the end of each sortie your score is converted into a rating, as in Star Raiders. A Class 1 Kamikaze trainee is lower than a Class 4 Runway Sweeper, and so on.

Zaxxon is brilliant — everyone seems to agree on that. Although Blue Max's graphics are not quite as fine it is a better game, and Bob Palin is to be congratulated on a brilliant feat of programming.

Zaxxon will soon be available for the Tandy Color Computer, and Blue Max is being put on the Commodore 64.

Pole Position

The other huge three-dimensional hit last year in the arcades was Atari's grand prix circuit-driving simulation Mount Fuji Racetrack. Its colour graphics are so sharp, so fast and so brilliant they have to be seen to be appreciated. If you have not seen them, go and do so.

Pole Position is the home-computer version, available on cartridge. It seems to be a fairly accurate copy except that all the advertising hoardings round the track have been left blank, which is a shame. Though the graphics are, inevitably, not up to the arcade standard they are still very impressive. This is one category where the official version is laps ahead, leaving the rip-offs versions for other micros looking tacky in comparison.

Like the arcade original, Pole Position gives a very strong sense of speed as you hurtle round the track. The super-realism of the three-dimensional effect adds a lot to the game. It is a great graphics demo. However, in other respects it is not very interesting. Control is wholly from the joystick with two gears: forward for low, back for high. That is not much of a challenge if, like me, you don't even like driving.

Donkey Kong/ Popeye

Donkey Kong is another arcade classic which it is best to see in the arcades before you consider the home version. The game involves the usual climbing of ladders, leaping over barrels, riding conveyor belts, collecting your girlfriend's accoutrements and generally trying to stay alive. Once again the Atari version is streets ahead of the competition. The particular strengths of this ROM-based game are the very smooth action, compulsive melodies and brilliant animation of Kong himself.

(continued on page 137)

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(continued from page 135)

If you are no particular fan of the arcade original, then Popeye is an interesting variation. Here you are Popeye the Sailor Man. Instead of Kong throwing down barrels while she shouts "Help!", here Olive Oyl throws little pink hearts. You have to catch them as they drift down while avoiding Bluto, who aims to grab you and grind you into pulp. The trick seems to be to punch the beehive so that it falls on Bluto's head while he's walking past the ladder.

The Donkey Kong tunes are nicer, but the Popeye colours are brighter. Both are extremely well animated and great fun to play.

Eastern Front/ Legionnaire

Some years ago Chris Crawford's Eastern Front was included in the cheap APX line of Atari programs. After all, who would want to buy it? It is only the best computer war game — of the sort more familiar from board games — ever written. It was later promoted to the main line of Atari programs, but only the price and the packaging changed. It still took three hours to play, had no Save Games feature, and you were certain to lose.

Now Atari has solved all the problems by putting the game on a ROM cartridge with a handful of play options from beginner to expert. You can learn to play with a couple of armies before you take on all Russia. In addition the top level has been made more difficult — as if it wasn't hard enough before. The result is a truly outstanding game.

Byte magazine gave Legionnaire a rave review, saying it was even better than Eastern Front. This time you are Caesar and command a small group of Roman legions. The background is a green scrolling landscape, produced using a multi-colour redefined character set, as in Eastern Front. Romans are red, Barbarians are blue . . . Your enemies are Gauls and other primitive types, who outnumber you by at least two to one.

Legionnaire also takes place in real time: it has arcade-game as well as war-game elements, including insistent sound effects. Perhaps the most attractive feature of the game used to be that you could use it as a training ground for Eastern Front. But with the new Eastern Front ROM, that has been taken care of.

Computer War

Our own Thorn-EMI pulled off something of a coup with Computer War, which is based on the film *War Games*. It came out very soon after the movie and, what is more, it is the company's best game yet.

You start with a map of North America, and pick up tiny white dots that show cruise missiles heading for Norad, and us for thermonuclear oblivion. Position your cursor over the dot, leap to that part of the landscape, find the missile and destroy it. Then again, and again, and again. Periodically you also have to solve codes and deactivate bases to make the world safe, finally, for Reaganomics.

The landscapes of Computer War are all three dimensional, and display a huge variety to resemble the actual landscapes of North America. That said, they are diagrammatic rather than naturalistic. The cruise missiles themselves are larger or smaller according to distance, and can whoosh right overhead.

With a few minor alterations, the description of Computer War could also apply to the fabulous Star Raiders. Both games can be reduced to "jumping from spot to spot and blasting things". For map read galactic chart; for cruise missiles read Zylons. Computer War also has the same instant changes of scene, achieved by page-flipping between screens held in RAM. The one thing Computer War has as its own is the brilliant colour effect of some of the landscapes, done using dynamic display-list interrupts.

Other games from Thorn-EMI include Ice Hockey, River Rescue and Orc Attack. I found River Rescue too tedious, Orc Attack too grizzly and Ice Hockey too fast. In Orc Attack you get your head sliced off. In Ice Hockey the computer takes a seven-nil lead in 30 seconds while you are trying to figure out how to play.

Well, you can't win them all.

Chess

The Atari Chess ROM was alright in its day, but is far too weak by contemporary standards. Now, however, much stronger opposition has appeared from Parker in the form of an 8K ROM cartridge.

The Parker program is a version of the tournament-winning Cyrus Chess from London-based Intelligent Software. It has also appeared as Spectrum IS Chess and as Cyrus Chess for the Dragon, while Parker also plans to market an IBM PC version.

As you would expect, the graphics of the Atari version are rather better than the others. It also has most of the features you could want, including the facility to take back moves and to have the computer replay a finished game automatically. You can also set up positions.

Considering all the features it packs into 8K — and which the Atari ROM lacks — Cyrus also plays extremely well. It can play on eight levels, from moving instantaneously to taking an average of five minutes per move. To give some idea of the strength, here is a game I played at Level 5. The computer averaged about 40 seconds per move. I took longer over mine, and the total time for 25 moves each was an hour:

White: Schofield; black: "Cyrus"
1. P-K4 P-QB4 2. N-KB3 P-Q3 3. P-Q4 P × P 4. N × P N-KB3 5. N-QB3 P-KN3 6. P-B4 N-QB3 7. N × N P × N 8. P-K5 P × P 9. Q × QCh K × Q 10. P × P N-N5 11. B-KB4 B-N2 12. 0-0-0Ch B-Q2 13. P-K6 P × P 14. N-K4 P-K4 15. B-K2 P-KR4 16. B-Q2 R-QN1 17. P-KR3 N-B3 18. B-KB3 N-K4 19. B-QB3 B-KR3Ch 20. B-Q2 B × BCh 21. R × B K-B2 22. N-B5 .... cries of "At last" after I had spent so long working up to this move.
.... K-Q3 23. N × B K × N 24. P-QB4 P-K3 25. P × N P × P

Look at the position, shown in the photo on page 135. Have I been outsmarted? I have won a piece for a pawn, but black's central pawns are now so strong I really have no choice but to swap off with the bishop. Or do I? Where did I go wrong in trying to crush this thing?

I would not claim this to be a great game, but black's moves would look perfectly rational and believable from quite a good human player: they look intelligent. Eventually white duly won by swapping off two of the central pawns, later the rooks, and queening the QRP.

Parker Chess is the best chess game I have seen for the Atari, and recommended. I hope to play it against Odesta's new Chess 7.0 at some time in the future.

Quickies

Other new Parker games include Q*Bert, the cubist, and Super Cobra, which is a version of Scramble played with a helicopter. Q*Bert is arcade quality. Super Cobra is brilliantly coloured, and rather easy to play. It should suit beginners.

English Software has continued to issue cassette-tape games for the Atari, and its range now runs to over a dozen. I tried Venus Voyager and found it unplayable. I also tried Xenon Raid, but the three-dimensional effect is minimal compared to the other games reviewed here and it is too fast for my reflexes.

Jet Boot Jack is a new game from English Software, which I got from Prism. It has been written by Jon Williams, who has obviously been doing the right thing: learning from the Americans. The result is a game that is far better, in my view, than any of this company's previous efforts. Jet Boot Jack is somewhat like Manic Miner on the Spectrum, except there are lifts, and you have to duck instead of jumping.

Possibly there will be a whole Jack Series, like Horace and Cuthbert. English Software also sells Steeple Jack. I loaded it twice but both times it crashed on the title page so I am none the wiser. A Spectrum game called Jumping Jack is also available from Imagine for the Atari — under the name of Leggit. It isn't bad as a Spectrum game, but it's not in the Atari class.

The Lone Raider is the first U.K. game to become part of Atari's main line of programs. It features three screens: the first is just a warm-up; the second is like Jumping Jack/Leggit meets Pacman. I never made it to the third screen, but at the end of the 10th there is a secret message.

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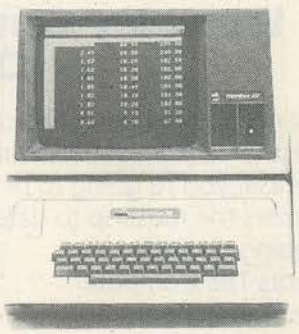

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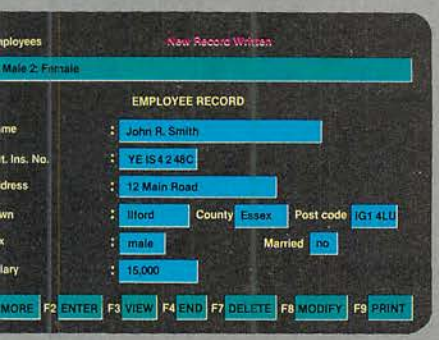

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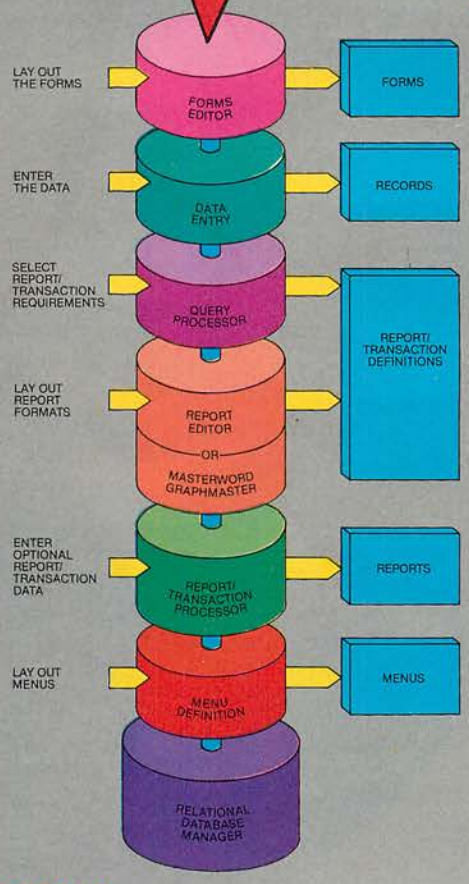

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Open File is the part of the magazine written by the readers of *Practical Computing*. All aspects of microcomputing are covered, from games to serious business software and utilities. Fully-debugged programs can be submitted for any micro, and for standard CP/M machines such as the Osborne and Superbrain. Programs can be in machine code or any language, including Forth and Pascal.

Submissions should include a brief description which explains what your program does, and how it does it. If possible it should be typed, with lines double-spaced. We need a printed program listing. Hand-written listings cannot be accepted. A tape or disc of the program helps if it is in a standard format.

When printing listings, please remember to use a new ribbon or double-intensity printing — faint listings reproduce badly. Use plain paper only, and try to list the program across either a 35-character or a 70-character width. Also, make sure all special graphics or inverse-video characters are either listed correctly or else include Rem statements to explain them fully.

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If you write in with a comment, correction or enquiry please remember to state the machine and the program title.

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>BBC

146 ACCESSING RECORDS
David Miller supplies a set of routines for indexing a random-access data file.

147 HIGH SCORE
Games players will appreciate Kathryn Armstrong's program which helps you keep a record of the top scores in all your favourites.

148 THE GRID
An amusing variation on the "stop the aliens" theme, written by Keith Miles.

>IBM PC

153 CREATION
Take a break from writing your quarterly report or planning next year's profits with this diverting combination of graphics and sound by Paul Myerscough.

153 MENU
John Lewis's Basica program displays an alphabetical list of the Basic files you have stored on disc.

>APPLE

155 GALACTIC INTRUDERS
An arcade-style game by P Walkley, with a step-wise playing style that is all its own.

>COMMODORE

161 TELEPHONE MONITOR
Michael Garrard has written a program that keeps track of the cost of a phone call while you are actually making it — but wouldn't it be better on ROM?

162 SAVING PAPER
If you have to list data to a printer you can save a great deal of paper with this program, which prints it out on the page in several parallel columns.

>SINCLAIR

165 EXTRA CHARACTERS
If you need more than the standard 21 user-defined characters available on the Spectrum, try this Basic routine by Magnus Davidson.

166 FOUR IN ONE
A strategy game for two players, written for the Spectrum by Charles Cowan.

>RESEARCH MACHINES

171 DISC COPIER
David Lane has a fast and efficient alternative to CP/M's Pip utility for copying the complete contents of a disc; it checks for errors too.

172 PLOTTING
A suite of programs by Daniel Freeman which offers a choice of styles for plotting a three-dimensional representation of any object.

>TANDY

173 ONE-WAY TICKET
A graphic edition of the well known Moon Lander game, played in real time and devised by George Speller.

173 SORT ROUTINE
This exceptionally fast Basic routine rearranges a substantial list of items; it is written for the Tandy Model II micro by R C G Bryant.

Send your contribution to:

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Accessing records

A COMMON technique for accessing records in a random-access file is the use of an index in which a record number is associated with each record key. FNRecno, ProcInsdel and ProcChange by David McMillan are routines for use in searching and updating an index file. They are listed here set in a test bed which generates some alpha keys at random and then allows you to perform various operations on them.

The routines require that the file consists of two arrays held in memory. The first array, Key$(), contains the keys of records held on the file and the second, Recno%(), contains all the possible record numbers that can exist in the file. The keys must be sorted into ascending sequence.

The record numbers are split into two sections. The first contains those that are in use, along with the keys to which they relate.

The function FNRecno returns either the record number for a key which exists or zero for a key which does not. It uses the binary chop method to search the list of keys. One parameter is required, namely the key of the desired record.

ProcInsdel inserts or deletes keys. On insertion of a key the number of the record to be used is obtained from the beginning of the section of unused record numbers. On deletion of a key, the freed record number will be placed at the beginning of the section of unused record numbers.

This method ensures that all available space within the file is used automatically. Like FNRecno it uses the binary chop method for searching. Two parameters are required: the key to be inserted or deleted, an I or D to indicate which of the options is required.

ProcChange allows a key to be changed. Normally it should never be necessary to change the key of a record. This procedure simply deletes the old key and immediately inserts the new key. The method of reusing freed record numbers ensures that the same record number is used for the new key. This procedure uses both FNRecno and ProcInsdel. Two parameters are required: the current key and the new key.

```
  10 REM  INDEX
  20 REM  by David McMillan
  30 REM  A program that demonstrat
es
  40 REM  routines:-
  50 REM              FNRECNO
  60 REM              PROCINSDEL
  70 REM              PROCCHANGE
  80 Max%=10
  90 DIM Key$(Max%),Recno%(Max%)
 100 Key$(0)="":Recno%(0)=0
 110 REM***FILL LIST OF RECORD NUMB
ERS***
 120 FOR L% = 1 TO Max%
 130 Recno%(L%) = L%
 140 NEXT
 150 REM*****GENERATE RANDOM KEYS**
*
 160 PRINT"NO. OF RECORDS (max ";Ma
x%;")";:INPUT Top%
 170 IF Top%<1 OR Top%> Max% VDU7:G
OTO160
 180 INPUT"KEY LENGTH",L2%
 190 IF L2%<1 VDU7:GOTO 180
 200 FOR L% = 1 TO Top%
 210 Key$(L%)=STRING$(L2%," ")
 220 Key$(L%)=""
 230 FORL1%=1TOL2%
 240 Key$(L%)=Key$(L%)+CHR$(64+RND(
26))
 250 NEXT
 260 NEXT
 270 REM******     SORT KEYS     ***
*****
 280 PROCSORT(1,Top%)
 290 PROCLIST
 300 REM******TEST ROUTINES********
******
 310 REPEAT
 320 PROCTEST
 330 UNTIL FALSE
 340 END
 350 REM*****   PROC SORT     ******
******
 360 DEF PROCSORT(M%,N%)
 370 LOCAL I%,J%
 380  IF M% > N%-1 THEN 430 ELSE IF
 N%-M% = 1 AND Key$(N%) < Key$(M%) P
ROCEXCH(M%,N%):GOTO 430 ELSE X% = FN
RN(M%,N%):Y$=Key$(X%):I% = M%: J% =
N%
 390  I% = I%-1:REPEAT I%=I%+1:UNTI
L I% = N% OR Y$ < Key$(I%):IF Y$ >=
Key$(I%) I%=N%
 400 J% =J%+1:REPEAT J% = J%-1:UNTI
L J% = M% OR Key$(J%) < Y$:IF Key$(J
%) >= Y$ J% = M%
 410  IF I% < J% PROCEXCH(I%,J%):I%
 = I%+1:J% = J%-1:GOTO 390 ELSE IF I
% < X% PROCEXCH(I%,X%):I% = I%+1 ELS
E IF X% < J% PROCEXCH(X%,J%):J% = J%
-1
 420 PROCSORT(M%,J%):PROCSORT(I%,N%
)
 430 ENDPROC
 440 REM*****    FN RN     ********
******
 450 DEFFNRN(E%,F%)=RND(F%-E%)+E%-1
 460 REM*****   PROC EXCH     *****
******
 470 DEFPROCEXCH(E%,F%)
 480 LOCALH$,H%
 490 H$=Key$(E%):Key$(E%)=Key$(F%):
Key$(F%)=H$
 500 H%=Recno%(E%):Recno%(E%)=Recno
%(F%):Recno%(F%)=H%
 510 ENDPROC
 520 REM******     PROC LIST     ***
******
 530 DEF PROCLIST
 540 IFTop%<1GOTO600
 550 VDU14
 560 FOR L%=1TOTop%
 570 PRINTKey$(L%),Recno%(L%)
 580 NEXT
 590 VDU15
 600 ENDPROC
 610 REM*****     PROC TEST     ***
******
 620 DEF PROCTEST
 630 INPUT"KEY",Key$
 640 INPUT"F-ind/I-nsert/D-elete/C-
hange",opt$
 650 IF opt$<>"F"GOTO680
 660 IF FNRECNO(Key$) = 0 PRINT"KEY
 NOT IN INDEX":VDU7 ELSE PRINT"RECOR
D NUMBER IS ";FNRECNO(Key$)
 670 GOTO730
 680 IFopt$="I" OR opt$ = "D" PROCI
NSDEL(Key$,opt$):PROCLIST:GOTO730
 690  IF opt$ <> "C" PRINT"NOT F, I
, D OR C":VDU7:GOTO640
 700 INPUT"NEW KEY",Nkey$
 710 PROCCHANGE(Key$,Nkey$)
 720 PROCLIST
 730 ENDPROC
 740 REM*****     FN RECNO     *****
******
 750 DEF FNRECNO(Key$)
 760 IF Top% <1 = 0
 770 low% = 1
 780 high% = Top%
 790 IF high% - low% < 2 GOTO840
 800 mid% = low% + (high%-low%)DIV2
 810 IF Key$>Key$(mid%) low% = mid%
:GOTO 790
 820 IF Key$<Key$(mid%) high% = mid
%:GOTO 790
 830 GOTO 860
 840  IF Key$(low%)=Key$ mid%=low%
:GOTO 860
 850  IF Key$(high%)=Key$ mid%=high
%ELSEmid%=0
 860 =Recno%(mid%)
 870 REM*****     PROC INSDEL     *
******
 880 DEF PROCINSDEL(Key$,opt$)
 890 IF Top% < 1 AND opt$ = "I" Top
%=0: mid%=1:GOTO1050
 900 IF Top% < 1 AND opt$ = "D" PRI
NT "INDEX EMPTY":VDU7:GOTO1240
 910 IF Top% >= Max% AND opt$ = "I"
 PRINT"INDEX FULL":VDU7:GOTO1240
 920 low%=1
 930 high% = Top%
 940 IF high% - low% < 2 GOTO 1000
 950 mid% = low% + (high%-low%)DIV2

 960 IF Key$>Key$(mid%) low% = mid%
: GOTO 940
 970 IF Key$<Key$(mid%) high% = mid
% :GOTO 940
 980 IF opt$ = "D" GOTO 1160
 990 PRINT"KEY ALREADY IN LIST":VDU
7:GOTO 1240
 1000 IFKey$=Key$(high%) mid% = high
%:GOTO 980
 1010 IF Key$ = Key$(low%) mid% = lo
w%: GOTO  980
 1020 IF opt$ = "I" GOTO 1040
 1030 PRINT"KEY NOT IN INDEX":VDU7:G
OTO1240
 1040  IF Key$>Key$(high%) mid%=high
%+1 ELSEIF Key$<Key$(low%) mid%=low%
 ELSEmid%=low%+1
 1050 Recno%=Recno%(Top%+1)
 1060 IF Top%<1 GOTO1120
 1070 IF mid% > Top% GOTO 1120
```

(listing continued opposite)

```
1080 FOR L%=Top%TOmid%STEP-1
1090 Key$(L%+1)=Key$(L%)
1100 Recno%(L%+1)=Recno%(L%)
1110 NEXT
1120 Key$(mid%)=Key$
1130 Recno%(mid%)=Recno%
1140 Top%=Top%+1
1150 GOTO 1240
1160 IFmid%=Top%GOTO 1230
1170 Recno%=Recno%(mid%)
1180 FOR L% = mid% TO Top%-1
1190 Key$(L%) = Key$(L%+1)
1200 Recno%(L%) = Recno%(L%+1)
1210 NEXT
1220 Recno%(Top%)=Recno%
1230 Top%=Top%-1
1240 ENDPROC
1250 REM*****      PROC CHANGE      *
*****
1260 DEF PROCCHANGE(Key$,Nkey$)
1270 IF FNRECNO(Key$) = 0 PRINT"OLD
 KEY NOT IN INDEX":VDU7:GOTO 1320
1280 IF FNRECNO(Nkey$) <> 0 PRINT "
NEW KEY ALREADY IN INDEX":VDU7:GOTO1
320
1290 Recno%=Recno%(FNRECNO(Key$))
1300 PROCINSDEL(Key$,"D")
1310 PROCINSDEL(Nkey$,"I")
1320 ENDPROC
>
```

High score

Kathryn Armstrong of Marlow has submitted a program called High Score. It keeps track of the scores from games you own or have typed in from pages of *Practical Computing*. The program will work with either disc or cassette. A colour monitor is preferable, although not essential.

First of all you have to initialise an empty file for saving the data. Openout a file with the following procedure:

```
10 DIM score (10,10)
20 f = OPENOUT ("D.SCORE")
30 FOR I% = 1 TO 10
40 FOR J% = 1 TO 10
50 PRINT #f,score (I%,J%)
60 NEXT J%: NEXT I%
70 CLOSE #f
```

Then run the program. It reads data and then displays both personal high scores and game scores. After it has been initialised, the program reads and saves the data each time it is called.

High score.

```
  10 MODE7
  20 PROCinit
  30 REPEAT
  40 PROCget_name
  50 IF table PROCtable_choice ELSE
PROCscores
  60 UNTIL FALSE
  70 ::::::::::::::::::::::::::::::
  80 ::::::::::::::::::::::::::::::
  90      DEFPROCinit
 100      ***********
 110 DIM SCORE(10,16)
 120 DIM NAME$(10)
 130 DIM GAME$(16)
 140 DIM SORT(10)
 150 DIMSORT$(10)
 160 REM set up colours eg r=red
 170 r=129
 180 g=130
 190 y=131
 200 b=132
 210 m=133
 220 c=134
 230 REM change VDU7
 240 *FX213,200
 250 *FX214,1
 260 PROCheader("HIGH SCORES")
 270 ON ERROR GOTO1080
 280 table=FALSE
 290 F=OPENUP("D.SCORE")
 300 FORI%=1TO10
 310 FORJ%=1TO10
 320 INPUT#F,SCORE(I%,J%)
 330 NEXT,
 340 CLOSE#F
 350 players=0
 360 REPEAT
 370 players=players+1
 380 READ NAME$(players)
 390 UNTIL NAME$(players)="END"
 400 players=players-1
 410 REM enter up to 9 players as d
ata before "END"
 420 DATA"SARAH","SIMON","KATHRYN"
 430 DATA"ROBERT","ANOTHER","END"
 440 No_games=0
 450 REPEAT
 460 No_games=No_games+1
 470 READ GAME$(No_games)
 480 UNTIL GAME$(No_games)="END"
 490 No_games=No_games-1
 500 REM enter up to 15 games as da
ta before "END"
 510 DATA"ROCKET RAID","DEFENDER","
SNAKE","G. PRIX","LANDER","MONSTER"
 520 DATA"HOG","END"
 530 ENDPROC
 540      DEFPROCget_name
 550      ***************
 560 PROCheader("HIGH SCORES")
 570 PRINTTAB(0,4)CHR$g"Choose a pl
ayer :"
 580 IF players<7 spc=2 ELSE spc=1
 590 FOR I=1 TO players
 600 PRINTTAB(14,I*spc+5)CHR$(I+64)
SPC2CHR$(c)NAME$(I)
 610 NEXT
 620 PRINTTAB(0,23)CHR$b"Press 'T'
for high score tables"
 630 PRINTTAB(0,24)CHR$b"Press 'ESC
APE' to play games";
 640 PRINTTAB(11,19)CHR$m"  Enter A
 to "CHR$(players+64)" ";
 650 REPEAT
 660 who=GET-64
 670 UNTIL (who>0 AND who<=players)
 OR who=20
 680 IF who=20 table=TRUE
 690 VDU7
 700 ENDPROC
 710      DEFPROCscores
 720      *************
 730 PROCheader("HIGH SCORES FOR "+
NAME$(who))
 740 IF No_games<8 spc=2 ELSE spc=1
 750 REPEAT
 760 FOR I=1 TO No_games
 770 PRINTTAB(6,I*spc+3)CHR$(64+I)C
HR$(m)GAME$(I);TAB(15)CHR$b":"CHR$(c
)SCORE(who,I)
 780 NEXT
 790 PRINTTAB(0,24)CHR$b"Press 'RET
URN' for another player"SPC4;
 800 PRINTTAB(0,21)CHR$r"To change
a score enter game letter :";
 810 REPEAT
 820 alter=GET-64
 830 UNTIL (alter>0 AND alter<=No_g
ames) OR alter=-51
 840 VDU7
 850 IF alter=-51 GOTO950
 860 PRINTTAB(0,24)CHR$r"Press 'RET
URN' to keep present score ";
 870 oldscore=SCORE(who,alter)
 880 PRINTTAB(6,alter*spc+3)CHR$(al
ter+64)CHR$(y)GAME$(alter)
 890 PRINTTAB(0,21);SPC39
 900 PRINTTAB(0,21)CHR$y"New score
for ";GAME$(alter);
 910 INPUT" : "SCORE(who,alter)
 920 IF SCORE(who,alter)>5000000 PR
INTTAB(0,21)CHR$r"!! SCORE TOO BIG !
!"SPC20:TIME=0:REPEAT UNTIL TIME>200
:GOTO890
 930 IF SCORE(who,alter)=0 SCORE(wh
o,alter)=oldscore
 940 VDU7
 950 UNTIL alter=-51
 960 VDU7
 970 ENDPROC
 980      DEFPROCheader(text$)
 990      *************
1000 CLS
1010 gap=(39-LEN(text$))/2
1020 FOR I=1 TO 2
1030 PRINTCHR$141CHR$(g)TAB(gap)tex
t$
1040 NEXT
1050 ENDPROC
1060 REM  SAVE/ERROR ROUTINE
1070      ******************
1080 IF ERR<>17:REPORT:STOP
1090 ON ERROR OFF
1100 PROCheader("HIGH SCORES")
1110 PRINT''CHR$m"Saving the data"
1120 IF PAGE=&1900 PRINT'CHR$m"Plea
se wait....";
1130 REM reset VDU7
1140 *FX213,100
1150 *FX214,6
1160 VDU7
1170 F=OPENOUT("D.SCORE")
1180 FORI%=1TO10
1190 FORJ%=1TO10
1200 PRINT#F,SCORE(I%,J%)
1210 NEXT,
1220 CLOSE#F
1230 REM delete if games not menu d
riven
1240 CHAIN"$.MENU"
1250 END
1260      DEFPROCtable_choice
1270      ******************
1280 REPEAT
1290 PROCheader("HIGH SCORE TABLES"
)
1300 PRINTTAB(0,4)CHR$g"Choose a ga
me :"
1310 IF No_games<8 spc=2 ELSE spc=1
1320 FOR I=1 TO No_games
1330 PRINTTAB(14,I*spc+4)CHR$(64+I)
CHR$(y)SPC2GAME$(I)
1340 NEXT
1350 PRINTTAB(0,24)CHR$b"Press 'P'
for player scores";
1360 PRINTTAB(13,20)CHR$m"Enter A t
o "CHR$(No_games+64)" ";
1370 REPEAT
1380 GAME=GET-64
1390 UNTIL (GAME>0 AND GAME<=No_gam
es) OR GAME=16
1400 VDU7
1410 IF GAME<>16 PROCtable
1420 UNTIL GAME=16
1430 table=FALSE
1440 ENDPROC
```

(continued on next page)

(continued from previous page)

```
 1450       DEFPROCtable
 1460       ************
 1470 PROCheader("HIGH SCORE TABLE F
OR "+GAME$(GAME))
 1480 PROCsort
 1490 IF players<7 spc=2 ELSE spc=1
 1500 FOR I=1 TO players
 1510 PRINTTAB(5,I*spc+6)CHR$(y)SORT
$(I)TAB(15)CHR$(b)":";CHR$(c)SORT(I)
 1520 NEXT
 1530 PRINTTAB(0,24)CHR$b"Press 'RET
URN' to continue ";
 1540 REPEAT
 1550 A=GET
 1560 UNTIL A=13
 1570 VDU7
 1580 ENDPROC
 1590       DEFPROCsort
 1600       ***********
 1610 FOR I%=1 TO players
 1620 SORT(I%)=SCORE(I%,GAME)
 1630 SORT$(I%)=NAME$(I%)
 1650 NEXT
 1660 FOR L1%=1 TO players
 1670 FOR L2%=2 TO players
 1680 IF SORT(L2%)>SORT(L2%-1) temp=
SORT(L2%):SORT(L2%)=SORT(L2%-1):SORT
(L2%-1)=temp:temp$=SORT$(L2%):SORT$(
L2%)=SORT$(L2%-1):SORT$(L2%-1)=temp$
 1690 NEXT,
 1700 ENDPROC
>A
```

The Grid

Keith Miles of Ely, Cambridgeshire has submitted this amusing variant on the old "stop the alien invasion" theme. It is also an interesting exercise in programming which makes the most of the structured nature of BBC Basic.

The aim of the game is to stop the aliens from occupying the Grid by descending to its bottom-most rung. To halt them you move your ship about the grid and try to hit them with your missiles, which have limited range. Additional hazards include the fallout from your own successful missile strikes and the fuel dropped by the X-Y Droids that inhabit the sides of the grid.

The program is controlled by a Repeat-Until loop in lines 160 and 170. Movement is achieved by using VDU31 to generate Print Tab commands. Hits are signalled through the Point command, to detect colour.

The Grid.

```
   10 REM THE-GRID: Copyright K.MILES.
  4, WILLOW WALK. ELY. CAMBS
   20 MODE2
   30 ENVELOPE3,129,2,4,6,28,14,7,0,0,
0,-80,80,80
   40 VDU23,1,0;0;0;0;
   50 DIMX%(18),Y%(18)
   60 PROCCHARACTERS
   70 HI%=0
   80 PROCTITLES
   90 CLS:SC%=0:Q%=1:W%=2:G%=1:L%=1:FU
EL%=0:LV%=0:SP%=8
  100 RA%=1:AL%=4
  110 IFAL%>18 AL%=18
  120 IFRA%>5 RA%=5
  130 R%=0:M%=0:C%=0:E%=0:H%=1:SX%=10:
SY%=28:A%=225:MX%=0:MY%=0:FL%=0:FUEL%=
FUEL%+200:S1%=10:S2%=10:GO%=1
  140 PROCBOARD
  150 PROCINVADERS
  160 REPEAT:PROCINV:PROCSHIP:PROCDROI
DS:PROCHOMER:FUEL%=FUEL%-RA%:IFFUEL%<0
 FUEL%=0
  170 COLOUR4:PRINTTAB(5,0);FUEL%;" ";
:UNTIL C%=AL%+1 OR E%=1 OR FUEL%<=0
  180 IFE%=1OR FUEL%<=0 THEN200
  190 IFC%=AL%+1AND AL%=18 LV%=1:SP%=S
P%-2:GOTO100 ELSE RA%=RA%+1:AL%=AL%+5:
GOTO110
  200 PROCINVADED
  210 COLOUR8:PRINTTAB(6,15)"THE-GRID"
:COLOUR3:PRINTTAB(0,30)"ANOTHER INVASI
ON?  ";
  220 *FX15,0
  230 A$=GET$:IFA$="Y"OR A$="y"GOTO80
  240 IFA$="N"OR A$="n" PRINTTAB(0,31)
;:END
  250 GOTO230
  260 DEFPROCBOARD
  270 COLOUR4:PRINTTAB(0,0)"FUEL ";FUE
L%:COLOUR6:PRINTTAB(10,0)"SCORE ";SC%
  280 COLOUR1:FORI%=1TO19:FORJ%=1TO28:
VDU31,I%,J%,240:NEXT:NEXT
  290 COLOUR5:PRINTTAB(0,30)"HI-SCORE
";HI%;
  300 ENDPROC
  310 DEFPROCCHARACTERS
  320 VDU23,225,195,219,219,255,255,21
9,129,0,23,226,0,129,219,255,255,219,2
19,195
  330 VDU23,227,254,252,24,124,124,24,
252,254,23,228,127,63,24,62,62,24,63,1
27
  340 VDU23,229,224,96,62,51,51,62,96,
224,23,230,24,60,36,36,60,255,195,129
  350 VDU23,231,24,60,60,24,24,60,36,0
,23,232,0,36,60,24,24,60,60,24
  360 VDU23,233,0,0,102,252,252,102,0,
0,23,234,0,0,102,63,63,102,0,0
  370 VDU23,235,24,36,90,189,189,90,36
,24,23,236,102,189,189,90,90,189,189,1
02
  380 VDU23,237,36,129,219,255,126,36,
66,129,23,240,24,24,24,255,255,24,24,2
4
  390 ENDPROC
  400 DEFPROCINVADERS
  410 COLOUR2:FORI%=0TO AL%:X%(I%)=1+R
ND(18):Y%(I%)=H%:VDU31,X%(I%),Y%(I%),2
37:NEXT
  420 ENDPROC
  430 DEFPROCINV
  440 R%=RND(AL%+1)-1
  450 M%=RND(3)-2
  460 IFY%(R%)=-32THEN560
  470 T1%=FNPT((X%(R%)+M%),Y%(R%)):IFT
1%=11 PROCFALLOUT:GOTO560
  480 T2%=FNPT((X%(R%)+M%),(Y%(R%)+1))
:IFT2%=11 PROCFALLOUT:GOTO560
  490 COLOUR1:VDU31,X%(R%),Y%(R%),240
  500 X%(R%)=X%(R%)+M%
  510 IFM%=0 Y%(R%)=Y%(R%)+1
  520 IFX%(R%)>19 X%(R%)=19
  530 IFX%(R%)<1 X%(R%)=1
  540 COLOUR2:VDU31,X%(R%),Y%(R%),237
  550 IFY%(R%)>28 E%=1
  560 ENDPROC
  570 DEFPROCSHIP
  580 KP%=0
  590 COLOUR1:VDU31,SX%,SY%,240
  600 *FX15,0
  610 IFINKEY(-99) VDU7:SX%=RND(18)+1:
SY%=RND(28):GOTO690
  620 IFINKEY(-2)AND SX%<19 KP%=1:SX%=
SX%+1:A%=228:IFFL%=0 X%=1:Y%=0:B%=234
  630 IFKP%=1THEN690
  640 IFINKEY(-65)AND SX%>1 KP%=1:SX%=
SX%-1:A%=227:IFFL%=0 X%=-1:Y%=0:B%=233
  650 IFKP%=1THEN690
  660 IFINKEY(-89)AND SY%>1 KP%=1:SY%=
SY%-1:A%=225:IFFL%=0 X%=0:Y%=-1:B%=231
  670 IFKP%=1THEN690
  680 IFINKEY(-1)AND SY%<28 SY%=SY%+1:
A%=226:IFFL%=0 X%=0:Y%=1:B%=232
  690 IFINKEY(-74)OR FL%>0 PROCMISSILE
  700 T%=FNPT(SX%,SY%):IFT%=11OR T%=13
OR T%=2 E%=1:GOTO720
  710 COLOUR6:VDU31,SX%,SY%,A%
  720 ENDPROC
  730 DEFPROCMISSILE
  740 IFFL%=0 FL%=1:MX%=SX%:MY%=SY%
  750 VDU31,MX%,MY%,240
  760 MY%=MY%+Y%:MX%=MX%+X%
  770 FL%=FL%+1
  780 IFFL%=11 OR MX%>19OR MX%<10R MY%
<10R MY%>28 FL%=0:GOTO840
  790 P%=FNPT(MX%,MY%)
  800 IFP%=2OR P%=3 PROCHIT:FL%=0:GOTO
840
  810 IFP%=11OR P%=5 FL%=0:GOTO840
  820 IFP%=13 FL%=0:FUEL%=FUEL%+50+(RN
D(RA%)*50):VDU31,MX%,MY%,240:SOUND0,-1
5,4,8:GOTO840
  830 COLOUR4:VDU31,MX%,MY%,B%
  840 ENDPROC
  850 DEFPROCHIT
  860 FORJ%=0TO AL%
  870 IFMX%<>X%(J%)ORMY%<>Y%(J%)THEN91
0
  880 COLOUR11:VDU31,MX%,MY%,236
  890 SC%=SC%+Y%(J%):C%=C%+1
  900 Y%(J%)=-32
  910 NEXT
  920 SOUND3,3,50,10
  930 COLOUR6:PRINTTAB(16,0);SC%
  940 IFHI%<SC% COLOUR5:HI%=SC%:PRINTT
AB(9,30);HI%;
  950 ENDPROC
  960 DEFPROCFALLOUT
  970 COLOUR1:VDU31,X%(R%),Y%(R%),240
  980 SC%=SC%+Y%(R%)
  990 C%=C%+1
 1000 Y%(R%)=-32
 1010 SOUND3,3,50,10
 1020 COLOUR6:PRINTTAB(16,0);SC%
 1030 IFHI%<SC% COLOUR5:HI%=SC%:PRINTT
AB(9,30);HI%;
 1040 ENDPROC
 1050 DEFPROCINVADED
 1060 FORI=1TO20:SOUND0,-15,6,10:FORJ=
1TO50:VDU19,1,RND(6);0;:NEXT:NEXT
 1070 VDU20
 1080 ENDPROC
 1090 DEFPROCDROIDS
 1100 VDU31,0,Q%,32,31,W%,29,32
 1110 Q%=Q%+G%:W%=W%+L%
 1120 IFQ%>27 G%=-1
 1130 IFQ%<2 G%=1
 1140 IFW%>=19 L%=-1
 1150 IFW%<2 L%=1
 1160 COLOUR4:VDU31,0,Q%,229,31,W%,29,
230
 1170 IFRND(1)>.97 COLOUR13:VDU31,W%,Q
%,235:SOUND0,-15,2,4
 1180 ENDPROC
 1190 DEFPROCTITLES
 1200 CLS:COLOUR1:FORI%=0TO30:FORJ%=0T
019:PRINTCHR$240;:NEXT:NEXT
 1210 COLOUR4:PRINTTAB(6,0)"THE-GRID"
 1220 COLOUR3:PRINTTAB(2,2)"CAN YOU HA
LT THE"'TAB(2,3)"ALIEN INVASION OF"'TA
B(6,4)"THE GRID."
 1230 PRINT'"AVOID COLLIDING WITHTHE A
LIENS AND EVADE";TAB(1,8)"THE FALL-OUT
 FROM"TAB(1,9)"YOUR OWN MISSILES."TAB(
2,10)"BEWARE OF HOMER."
 1240 PRINTTAB(1,12)"HIT THE FUEL DUMP
S"TAB(1,13)"DROPPED BY THE X-Y"TAB(2,1
4)"DROIDS TO REFUEL."
 1250 COLOUR2:PRINTTAB(2,16)CHR$237"
ALIEN"
 1260 COLOUR5:PRINTTAB(2,17)"@  HOMER"
 1270 COLOUR4:PRINTTAB(2,18)CHR$230"
X-Y DROID"
 1280 COLOUR11:PRINTTAB(2,19)CHR$236"
 FALLOUT"
 1290 COLOUR13:PRINTTAB(2,20)CHR$235"
 FUEL DUMP"
 1300 COLOUR6:PRINTTAB(2,21)CHR$225"
YOUR SHIP"
 1310 COLOUR3:PRINTTAB(1,23)"CONTROLS:
"TAB(2,25)"CAPS-LOCK  LEFT"TAB(2,26)"C
TRL       RIGHT"TAB(2,27)"]           U
P"TAB(2,28)"SHIFT      DOWN"TAB(2,29)"
RETURN     FIRE"TAB(2,30)"SPACE      P
ANIC"
 1320 COLOUR4:PRINTTAB(3,31)"PRESS <SP
ACE>";
 1330 I=0:REPEATI=I+1:SOUND0,-15,I,10:
UNTILI=5
 1340 IFINKEY$(100)=" "THEN1350ELSE133
0
 1350 ENDPROC
 1360 DEFFNPT(d%,e%)
 1370 =POINT((d%*64)+32,1008-(e%*32))
 1380 DEFPROCHOMER
 1390 IFLV%=0THEN1490
 1400 IFSP%<2 SP%=2
 1410 GO%=GO%+1:IFGO%<>SP% THEN1490
 1420 Q1%=S1%:Q2%=S2%
 1430 S1%=S1%+(S1%>SX%)-(S1%<SX%):S2%=
S2%+(S2%>SY%)-(S2%<SY%)
 1440 IFFNPT(S1%,S2%)=6 E%=1
 1450 IFFNPT(S1%,S2%)=11 S1%=Q1%:S2%=Q
2%:GOTO1480
 1460 COLOUR1:VDU31,Q1%,Q2%,240
 1470 COLOUR5:VDU31,S1%,S2%,64
 1480 GO%=0
 1490 ENDPROC
```

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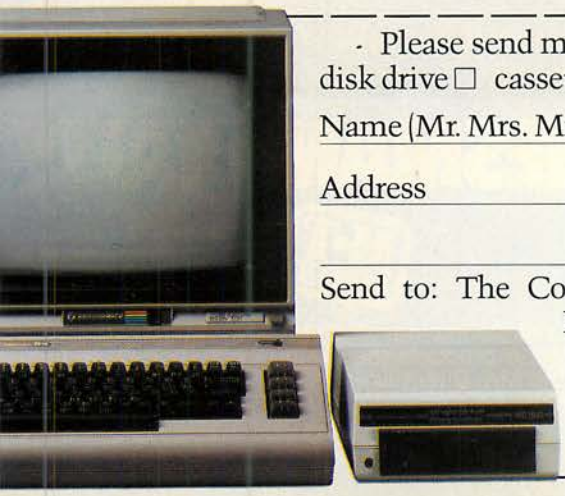

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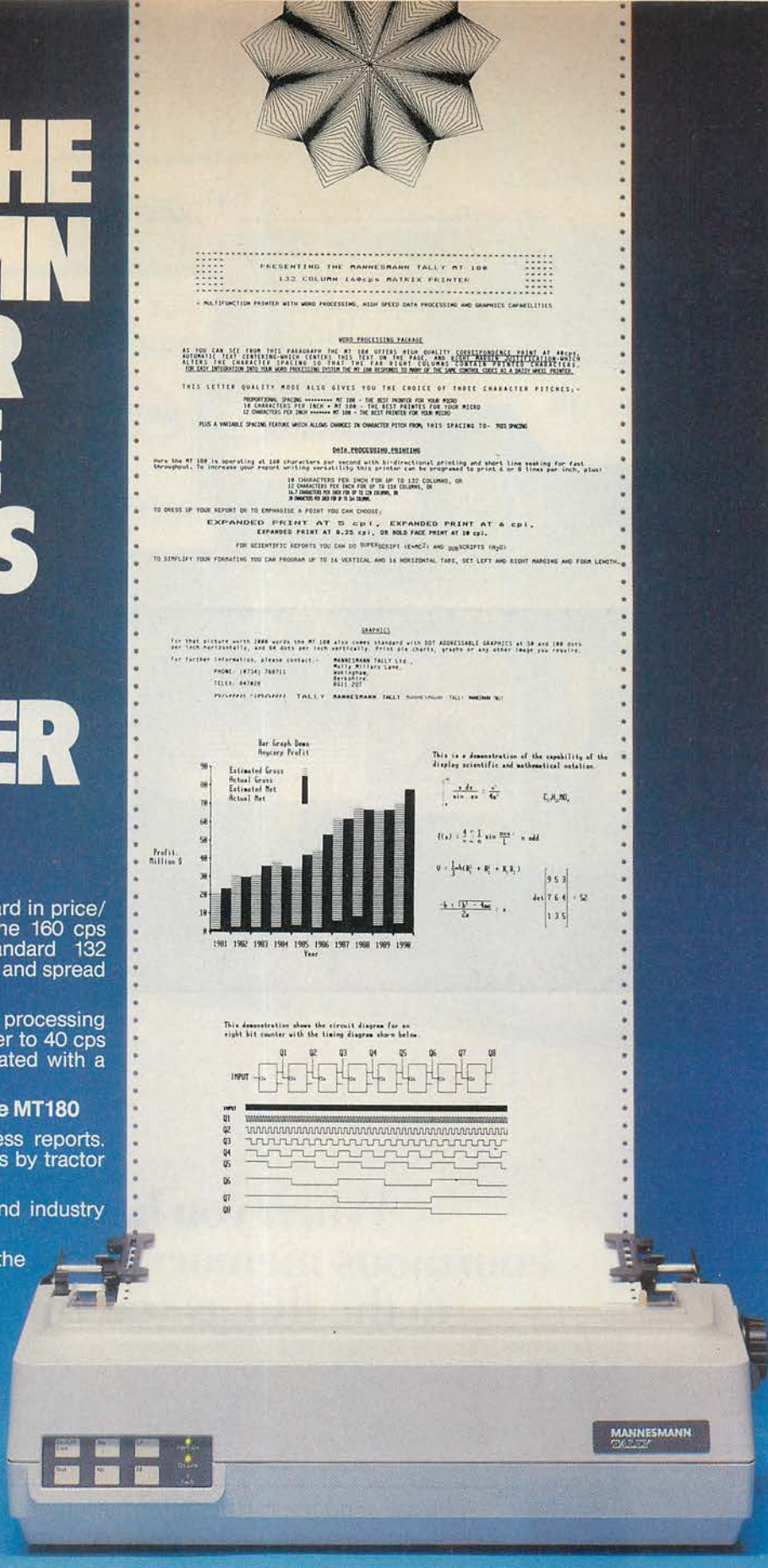

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Please be brief

THIS SECTION of Open File is for the IBM PC and its numerous emulators. Actually, any routines in Basica or Microsoft's GWBasic are acceptable, which means most pseudo 16-bit micros. If you send programs on disc they must be IBM PC readable.

When sending contributions, please try to make them either original or short — or preferably both. While some fascinating programs have been received already, most have been several pages long. About 100 lines of code is the maximum that is likely to be used. And even if we had room to publish anything longer, would anyone have the time to key it in?

Creation

The first offering this month is Creation from Paul Myerscough of north London. It is very short: what it does is throw IBM characters on to the screen at random, while the sound routine makes a noise like Hollywood's idea of a computer. On our PC, Breaking the program produces an interesting ruled screen.

Menu

The second program is Menu from John Lewis of Oxford. It can be loaded automatically by an Autoexec.Bat file after the Keyboard U.K. routine — see pages 6 to 31 of the DOS handbook for an explanation of how to do this.

Menu is written for version 2 of Basica, which lists files four across, so it will need to be modified if you have version 1.05, which lists them six across the screen. It works by setting the colour of the characters on the screen to black, making them invisible. The Files command then displays on the screen an invisible directory of the disc. Using the screen command, each entry is read into an array — lines 100 to 190. A simple sort routine in lines 200 to 250 then arranges them alphabetically.

Then line 280 turns the display on again, and the files on the disc are displayed in three columns. A prompt on the bottom line of the screen asks you to input the number of the program required; alternatively you can look at the files on the other drive. If you choose the former option the program prints a reminder that function key F1 is programmed to recall the menu program, then after a short delay the program is Run.

If the response is an alpha character, it is checked to see if it is lower-case a or b. If so, it is changed to upper case in lines 540 or 550 so that the drive designation can be changed. The new designation is passed back to line 80, where the Files procedure is repeated.

Error routines at lines 520 and 600 take care of the cases where an invalid program number is entered or the wrong disc-drive letter is input. In line 60, only files with the .Bas extension are chosen. It would be possible to display all the files on a disc but since they may not run under Basic it would not serve much purpose.

Creation.

```
0  REM CREATION BY PAUL MYERSCLOUGH
10 CLS:KEY OFF
20 ROW = INT (RND*25)+1:COL=INT(RND*80)+1
30 ASCI=INT(RND*255)+1
40 IF ASCI>6 AND ASCI<14 THEN GOTO 30
50 IF ASCI>27 AND ASCI<33 THEN GOTO 30
60 ATTR1=INT(RND*17):ATTR2=INT(RND*2)+6
70 NOISE = RND*3000+1000
80 LOCATE ROW,COL:COLOR ATTR1,ATTR2
90 PRINT CHR$(ASCI);:SOUND NOISE,1
100 GOTO 20
```

Menu.

```
10 REM DISPLAYS A MENU OF BASIC PROGRAMS ON THE DISK
20 REM  ADAPTED BY JOHN LEWIS      DECEMBER 1983
30 DIM TITLE$(100)
40 KEY OFF
50 WIDTH 80
60 DRIVE$ = "A:*.BAS"                              'ENSURES LOOKS AT DRIVE 'A' FIRST
70 KEY 1, "RUN" + CHR$(34) + "MENU" + CHR$(13)          ' KEY 1 RUNS MENU
80 CLS : COLOR 0,0                                 'SETS COLOUR TO BLACK - INVISIBLE
90 FILES DRIVE$                                         'GETS .BAS FILES
100 D$ = CHR$(SCREEN(1,1))                             'GETS DRIVE LETTER
110 FOR SR% = 2 TO 24                                       'ROW ON SCREEN
120 FOR SC% = 0 TO 55 STEP 18                         'FOUR COLUMNS DISPLAYED
130 IF CHR$(SCREEN(SR%,SC%+1))= " " THEN 200          'STOP WHEN NO MORE NAME
140 PR% = PR% + 1                                           'ARRAY NUMBER
150 FOR L% = 1 TO 8                                   'READ FIRST 8 CHARACTERS
160 TITLE$(PR%) = TITLE$(PR%) + CHR$(SCREEN(SR%,SC%+L%))       'BUILD UP TITLE
170 NEXT L%
180 NEXT SC%
190 NEXT SR%

200 FOR N% = 1 TO PR% - 1
210 FOR P% = N% + 1 TO PR%
220 IF TITLE$(P%) < TITLE$(N%) THEN 260
230 NEXT P%
240 NEXT N%

250 GOTO 280
260 Z$ = TITLE$(P%) : TITLE$(P%) = TITLE$(N%) : TITLE$(N%) = Z$
270 GOTO 230
280 COLOR 7,0
290 LOCATE 1,32 :PRINT "Basic Programs on Drive ";D$

300 FOR SC% = 1 TO 53 STEP 26                          'DISPLAY IN 3 COLUMNS
310 FOR SR% = 3 TO 23                                       'ON ROWS 3 TO 23
320 PS% = PS% + 1                                             'ARRAY NUMBER
330 IF TITLE$(PS%) = "" THEN 380  ELSE LOCATE SR%,SC%
340 PRINT USING "##";PS% ;
350 PRINT "  ";TITLE$(PS%)
360 NEXT SR%
370 NEXT SC%

380 R$ = "" : LOCATE 25,1 : PRINT SPACE$(70) ;
390 LOCATE 25,1:PRINT "Enter number of program required or disk letter   " ;
400 I$ = INKEY$
410 PRINT I$ ;
420 IF I$ = CHR$(13) THEN 460
430 IF I$ = "" THEN 400
440 R$ = R$ + I$
450 GOTO 400
460 FOR T = 1 TO 1000 : NEXT
470 IF ASC(R$) > 64 THEN 540                      'CHECKS FOR ALPHA OR NUMERIC
480 IF VAL(R$) < 1 OR VAL(R$) > PR% THEN 520
490 LOCATE 25,1 : PRINT "                    Remember F1 runs the menu program
                    ";
500 FOR T% = 1 TO 3000 : NEXT
510 IF D$ = "A" THEN RUN TITLE$(VAL(R$)) ELSE RUN "B:" + TITLE$(VAL(R$))
520 LOCATE 25,1:PRINT" Please enter a number which refers to a program shown";
530 FOR T% = 1 TO 4000 : NEXT : GOTO 380          'DELAY TO READ ERROR MESSAGE
540 IF ASC(R$) = 97 THEN R$ = "A"                          'CONVERTS a TO A
550 IF ASC(R$) = 98 THEN R$ = "B"                          'CONVERTS b TO B
560 IF R$ = "A" OR R$ = "B" THEN DRIVE$ = R$ + ":*.BAS"
570 FOR X% = 1 TO PS% : TITLE$(X%) = "" : NEXT
580 PR% = 0 : PS% = 0
590 GOTO 80
600 LOCATE 25,1:PRINT "Please enter a valid drive letter   -  either A or B
              "; : GOTO 530                       'SPACE TO CLEAR EXISTING LINE
```

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Galactic Intruders

P WALKLEY of Great Sutton has designed and coded an arcade-style game. Since it is in Basic the play is slower and more jerky than the assembler equivalent might be, but that does serve to give it a playing style of its own.

You play the ship at the bottom of the screen, firing at five intruders above you. When they land, each lays an egg which you must subsequently avoid. A fuel limit is maintained against your movement, which is replenished every 150 points. The arrow keys move the ship, and Return stops movement and the space bar fires.

Shape table.

```
6000- 1B 00 38 00 4C 00 65 00
6008- 80 00 9A 00 B9 00 D7 00
6010- EA 00 0C 01 2E 01 51 01
6018- 7A 01 A4 01 B6 01 C1 01
6020- CE 01 E5 01 01 02 17 02
6028- 3A 02 5D 02 74 02 85 02
6030- A5 02 C8 02 E6 02 04 03
6038- 09 2D 2D 25 3F 3F 67 29
6040- 3C 2C 3C 2C 3C 2C 3C 17
6048- 3E 3E 00 00 29 2D 2D 25
6050- 3F 3F 3F 2C 3C 0C 2D 05
6058- 38 67 29 3C DF 23 2D 2D
6060- E5 3F 3F 00 00 09 2D 2D
6068- 05 38 3F 3F 4C 09 25 3F
6070- 07 28 E5 67 2D 38 DF 03
6078- 28 2D 2D 3C 3F 3F 07 00
6080- 49 09 25 27 6D 38 3F 3F
6088- 3F 2C 2D 2D 2D DC FF 3B
6090- 2C 4D 25 FF 67 2D 25 3F
6098- 07 00 09 2D 2D 05 38 3F
60A0- 3F 27 4D 09 25 FF 1B 28
60A8- 2D 2D 1C 3F 3F 27 25 27
60B0- 2D 2D 2D 3C 3F 3F 3F 00
60B8- 00 49 2D 2D 38 3F 3F 07
60C0- 28 4D 29 3C DF 3B 2C 2D
60C8- 2D E5 3F 3F 27 2D 38 2C
60D0- 2D 2D 3C 3F 3F 00 00 09
60D8- 25 27 25 25 25 25 25 25
60E0- 3F 3F 3F 27 2D 2D 2D 2D
60E8- 00 00 49 2D 2D 38 3F 3F
60F0- 07 28 4D 09 25 FF DB 67
60F8- 2D 2D 25 3F 3F 3F 28 4D
6100- 09 25 FF DB 67 2D 2D E5
6108- 3F 3F 00 00 09 2D 2D 38
6110- 3F 67 09 2D 05 38 FF 1B
6118- 28 2D 2D 25 3F 3F 3F 27
6120- 6D 49 25 FF DB 67 2D 2D
6128- 2D 1C 3F 3F 07 00 49 2D
6130- 2D 38 3F 3F 07 28 6D 09
6138- 25 FF 3B 3F 2C 0D 6D 25
6140- FF FF 27 6D 29 2D 3C FF
6148- 1B 67 2D 2D E5 3F 3F 00
6150- 00 6D 49 09 25 FF DF 1F
6158- 27 2D 2D 2D 2D 25 3F 3F
6160- 3F 3F 27 2D 2D 2D 2D 25
6168- 3F 3F 3F 3F 27 6D 29 4D
6170- 25 FF 3B DF 67 49 25 3F
6178- 00 00 6D 49 09 25 FF DF
6180- 1F 27 6D 2D 6D 25 FF 3B
6188- DF 27 2D 2D 2D 2D 25 FF
6190- 3B DF 27 6D 29 4D 25 3F
6198- 3F 3F 3F 67 29 2D 2D 1C
61A0- 3F 3F 00 00 49 2D 6D 38
61A8- 3F 3F 27 2D 2D 2D 3C 3F
61B0- 3F 67 2D 2D 00 00 49 21
61B8- 24 24 24 35 36 36 36 05
61C0- 00 49 29 38 28 38 28 38
61C8- 28 38 28 28 00 00 49 2D
61D0- 2D 25 3F 3F 3F 2C E5 27
61D8- 25 27 2D 38 27 2D 2D 2D
61E0- 3C 3F 3F 07 00 29 2D 2D
61E8- 2D 3C 3F 3F 3F 2C 3C 2C
61F0- 2D 2D 3C 3F 3F 2C 3C 2C
61F8- 2D 2D 2D 3C 3F 3F 3F 07
6200- 00 29 3C 2C 3C 2C 2D 2D
6208- 3C 3F 3F 2C 3C 2C 2D 2D
6210- 2D 3C 3F 3F 3F 07 00 09
6218- 2D 2D 05 38 3F 3F 27 6D
6220- 09 2D 38 3F DF 27 6D 29
6228- 2D DC DB 3B 2C 4D 29 3C
6230- DF 3B 2C 2D 2D E5 3F 3F
6238- 07 00 29 4D 09 25 FF DB
6240- 27 6D 49 25 FF DB 27 2D
6248- 2D 2D 25 3F 3F 3F 27 6D
6250- 49 25 FF DB 27 6D 49 25
6258- FF DB 3F 00 00 09 2D 2D
6260- 25 3F 3F 67 29 3C 2C 3C
6268- 2C 3C DF 0B 2D 2D 25 3F
6270- 3F 3F 00 00 29 2D 2D 25
6278- 3F 3F 3F 24 24 24 24 35
6280- 36 36 36 05 00 49 2D 2D
6288- 38 3F 3F 2C 4D 2D 38 DF
6290- 1B 27 6D 49 25 FF DB 27
6298- 6D 49 E5 FF 3B 2C 2D 2D
62A0- 1C 3F 3F 00 00 29 4D 09
62A8- 25 FF DB 27 6D 09 E5 FF
62B0- 3B 2C 2D 2D 05 38 3F 3F
62B8- 27 6D 09 25 FF 1B 27 2D
62C0- 2D 2D 1C 3F 3F 3F 00 00
62C8- 29 2D 2D 05 38 3F 3F 67
62D0- 49 29 3C DF 03 28 2D 2D
62D8- 1C 3F 3F 27 25 27 2D 2D
62E0- 2D 3C 3F 3F 07 00 09 2D
62E8- 6D 25 3F 3F 3F 27 2D 4D
62F0- 2D 3C DF 1B 27 24 24 2C
62F8- 36 36 6E 49 24 24 2C 36
6300- 36 2E 00 00 49 29 4D F8
6308- DB 1B 44 69 69 01 F8 1B
6310- FF 1B 6C 09 6D 09 DC FB
6318- FB 40 03 4D 49 E1 1B 3F
6320- 00 00 FF
```

Basic program.

```
5  IF  PEEK (24576) <  > 27 THEN
     PRINT  CHR$ (4);"BLOAD INT-
     1"
10  HGR2 : HGR : HCOLOR= 3: ROT=
     0: SCALE= 1: POKE 232,0: POKE
     233,96: DIM A%(20,16),X%(5),
     Y%(5)
15  GOSUB 10000: GOTO 600
199  REM  MOVE INVADER
200 IN = IN + 1:DX =  INT ( RND (
     1) * 3 - 1):DY =  INT ( RND
     (1) * 2): IF IN = 5 THEN IN =
      - 1: GOTO 200
205  IF X%(IN) + DX < 1 OR X%(IN)
      + DX > 20 THEN 200
210  IF Y%(IN) + DY < 17 THEN 240

215  XDRAW 12 AT X%(IN) * 10,Y%(I
     N) * 10 + 30:A%(X%(IN),Y%(IN
     )) = 0: IF EF = 1 THEN  XDRAW
     13 AT EX * 10,EY * 10 + 30:A
     %(EX,EY) = 0:EF = 0
220 EX = X%(IN):EY = Y%(IN):EF =
     1: IF A%(EX,EY) = 0 THEN  DRAW
     13 AT EX * 10,EY * 10 + 30:A
     %(EX,EY) = 13
225  IF A%(EX,EY) = 11 THEN 2000
230 X%(IN) =  INT ( RND (1) * 20 +
     1):Y%(IN) = 2: IF A%(X%(IN),
     Y%(IN)) <  > 0 THEN 230
235  DRAW 12 AT X%(IN) * 10,Y%(IN
     ) * 10 + 30:A%(X%(IN),Y%(IN)
     ) = 12: RETURN
240  IF A%(X%(IN) + DX,Y%(IN) + D
     Y) <  > 0 THEN 200
245  XDRAW 12 AT X%(IN) * 10,Y%(I
     N) * 10 + 30:A%(X%(IN),Y%(IN
     )) = 0:X%(IN) = X%(IN) + DX:
     Y%(IN) = Y%(IN) + DY: DRAW 1
     2 AT X%(IN) * 10,Y%(IN) * 10
      + 30:A%(X%(IN),Y%(IN)) = 12
     : RETURN
299  REM  MOVE INVADER MISSILE
300  XDRAW 15 AT IX * 10,IY * 10 +
     30:A%(IX,IY) = 0:IY = IY + 1
     : IF IY = 17 THEN IX = 0:IY =
     0:FI = 0: RETURN
305  IF A%(IX,IY) = 0 THEN A%(IX,
     IY) = 15: DRAW 15 AT IX * 10
     ,IY * 10 + 30:A%(IX,IY) = 15
     : RETURN
310  IF A%(IX,IY) = 13 THEN  XDRAW
     13 AT EX * 10,EY * 10 + 30:E
     X = 0:EY = 0:EF = 0:A%(IX,IY
     ) = 0:IX = 0:IY = 0:FI = 0: RETURN

315  IF A%(IX,IY) = 11 THEN 2000
320  IF A%(IX,IY) = 12 THEN IY =
     IY - 1:A%(IX,IY) = 15: DRAW
     15 AT IX * 10,IY * 10 + 30: RETURN

325  IF A%(IX,IY) = 14 THEN  XDRAW
     14 AT MX * 10,MY * 10 + 30:M
     X = 0:MY = 0:F = 0:SC = SC +
     10:A%(IX,IY) = 0:FI = 0
330  SCALE= 2: DRAW 27 AT IX * 10
      - 5,IY * 10 + 35:Z =  USR (
     7975): XDRAW 27 AT IX * 10 -
     5,IY * 10 + 35: SCALE= 1: DRAW
     27 AT IX * 10,IY * 10 + 30:Z
      =  USR (6950): XDRAW 27 AT
     IX * 10,IY * 10 + 30:IX = 0:
     IY = 0: RETURN
374  REM  SET INVADER MISSILE
375 QQ =  INT ( RND (1) * 5):IX =
     X%(QQ):IY = Y%(QQ) + 1: IF I
     Y > 14 THEN IX = 0:IY = 0:FI
      = 0: RETURN
380  IF A%(IX,IY) = 0 THEN A%(IX,
     IY) = 15: DRAW 15 AT IX * 10
     ,IY * 10 + 30: RETURN
385  GOTO 375
499  REM  ** YOUR MISSILE
500  XDRAW 14 AT MX * 10,MY * 10 +
     30:A%(MX,MY) = 0:MY = MY - 1
     : IF MY = 0 THEN MX = 0:F =
     0: RETURN
505  IF A%(MX,MY) = 0 THEN A%(MX,
     MY) = 14: DRAW 14 AT MX * 10
     ,MY * 10 + 30: RETURN
510  IF A%(MX,MY) = 15 THEN  XDRAW
     15 AT IX * 10,IY * 10 + 30:S
     C = SC + 10:A%(IX,IY) = 0:FI
      = 0:F = 0:MX = 0:MY = 0: GOSUB
     330: RETURN
513  IF A%(MX,MY) <  > 12 THEN  STOP

515  XDRAW 12 AT MX * 10,MY * 10 +
     30:A%(MX,MY) = 0:F = 0: FOR
     I = 0 TO 4: IF X%(I) = MX AND
     Y%(I) = MY THEN 525
520  NEXT : STOP
```

(continued on next page)

(continued from previous page)

```
525 X%(I) =  INT ( RND (1) * 20 +
    1):Y%(I) = 2: IF A%(X%(I),Y%
    (I)) <  > 0 THEN 525
530  DRAW 12 AT X%(I) * 10,Y%(I) *
    10 + 30:A%(X%(I),Y%(I)) = 12
    :I = 0:F = 0:SC = SC + 30
535  SCALE= 2: ROT= 16: DRAW 27 AT
    MX * 10 - 5,MY * 10 + 15:Z =
     USR (3900): XDRAW 27 AT MX *
    10 - 5,MY * 10 + 15: SCALE=
    1: ROT= 0: DRAW 27 AT MX * 1
    0,MY * 10 + 30:Z =  USR (300
    0): XDRAW 27 AT MX * 10,MY *
    10 + 30:MX = 0:MY = 0: RETURN

574  REM ** MOVE YOU
575  XDRAW 11 AT YX * 10,YY * 10 +
    30:A%(YX,YY) = 0:YX = YX + D
    : IF YX < 1 OR YX > 20 THEN
    YX = YX - D
580  IF A%(YX,YY) = 13 OR A%(YX,Y
    Y) = 12 OR A%(YX,YY) = 15 THEN
    2000
585  DRAW 11 AT YX * 10,YY * 10 +
    30:A%(YX,YY) = 11: RETURN
599  REM **MAIN LOOP
600 K =  PEEK ( - 16384): POKE  -
    16368,0
605  IF K = 136 THEN D =  - 1
610  IF K = 149 THEN D = 1
613  IF K = 13 THEN D = 0
615  IF FL > 0 AND D <  > 0 THEN
     GOSUB 575
617  IF FL = 0 THEN 2000
620  IF K = 32 AND F = 0 THEN K =
    0:MX = YX:MY = YY - 1:F = 1:
     DRAW 14 AT MX * 10,MY * 10 +
    30:A%(MX,MY) = 14: FOR I = 2
    56 TO 300:Z =  USR (I): NEXT

625  IF F = 1 THEN  GOSUB 500
630  IF D <  > 0 THEN FL = FL - 1
    : IF FL <  = 0 THEN D = 0
635  IF FL >  - 1 THEN  HCOLOR= 0
    : HPLOT 242,169 - FL TO 248,
    169 - FL: HCOLOR= 3
640  IF FI = 0 AND  RND (1) > .3 THEN
    FI = 1: GOSUB 375
645  IF FI = 1 THEN  GOSUB 300
650  GOSUB 200
655  IF F = 1 THEN  GOSUB 500
660  IF FI = 1 THEN  GOSUB 300
665  IF FL = 20 THEN  FOR I = 1 TO
    4: FOR J = 20 TO 10 STEP  -
    1:Z =  USR (J * 256 + J): NEXT
    J,I
695  IF TS <  > SC THEN  GOSUB 70
    0
696  IF SC > HS THEN  GOSUB 750
698  GOTO 600
699  REM ** UPDATE SCORE
700 SC$ =  STR$ (TS): FOR I = 1 TO
     LEN (SC$)
705 NU =  VAL ( MID$ ((SC$),I,1))
    : IF NU = 0 THEN  XDRAW 10 AT
    45 + I * 10,10: GOTO 713
710  XDRAW NU AT 45 + I * 10,10
713  NEXT :FC = FC + (SC - TS): IF
    FC > 130 THEN FC = 0:FL = 13
    0:PP = 1
715 TS = SC:SC$ =  STR$ (SC): FOR
    I = 1 TO  LEN (SC$):NU =  VAL
    ( MID$ ((SC$),I,1)): IF NU =
    0 THEN  DRAW 10 AT 45 + I *
    10,10: GOTO 725
720  DRAW NU AT 45 + I * 10,10
725  NEXT : IF PP = 1 THEN PP = 0
    : GOSUB 10095
730  RETURN
749  REM  ** HIGH SCORE
750 HS$ =  STR$ (HS): FOR I = 1 TO
     LEN (HS$)
755 NU =  VAL ( MID$ ((HS$),I,1))
    : IF NU = 0 THEN  XDRAW 10 AT
    215 + I * 10,10: GOTO 760
758  XDRAW NU AT 215 + I * 10,10
760  NEXT :HS = SC
765 HS$ =  STR$ (HS): FOR I = 1 TO
     LEN (HS$):NU =  VAL ( MID$
    ((HS$),I,1)): IF NU = 0 THEN
     DRAW 10 AT 215 + I * 10,10:
     GOTO 780
770  DRAW NU AT 215 + I * 10,10
780  NEXT : RETURN
1999  REM  ** END GAME
2000  FOR I = 40 TO 10 STEP  - 2:
    Z =  USR (256 * I + 20): CALL
    787: NEXT : TEXT : HOME : POKE
    766, INT (HS / 256): POKE 76
    7,HS -  PEEK (766) * 256
2005  VTAB 10: PRINT "YOU WERE DE
    STROYED,": PRINT : PRINT : PRINT
    "BUT YOU SCORED ";SC: PRINT
    : PRINT : PRINT "HIGH SCORE
    IS ";HS: POKE  - 16368,0
2010  VTAB 24: INVERSE : PRINT "P
    RESS THE SPACEBAR TO PLAY AG
    AIN.....";: GET A$: NORMAL
    : IF A$ <  > CHR$ (32) THEN
     END
2015  CLEAR : RESTORE : CALL 6245
    0:HS =  PEEK (766) * 256 +  PEEK
    (767): HOME : ROT= 0: SCALE=
    1: DIM A%(20,16),X%(5),Y%(5)
    : GOSUB 10020: GOTO 600


10000  TEXT : HOME : INVERSE : PRINT
     SPC( 54);: NORMAL : PRINT "
     INTRUDERS ";: INVERSE : PRINT
     SPC( 73);: NORMAL : PRINT "
     BY ";: INVERSE : PRINT  SPC(
    72);: NORMAL : PRINT " P.WAL
    KLEY ";: INVERSE : PRINT  SPC(
    55);: NORMAL
10005  PRINT : PRINT "   DESTROY
    AS MANY ALIENS AS POSSIBLE":
     PRINT : PRINT "BEFORE YOU R
    UN OUT OF FUEL OR ARE": PRINT
    : PRINT "HIT."
10010  PRINT : PRINT "USE :-": PRINT
    : PRINT "THE ARROW KEYS TO M
    OVE,": PRINT : PRINT "'RETUR
    N' TO STOP MOVING,": PRINT :
     PRINT "AND THE SPACE BAR TO
     FIRE."
10015  VTAB 24: INVERSE : PRINT "
    PRESS ANY KEY TO CONTINUE...
    ...";: GET A$: NORMAL
10020  FOR I = 1 TO 18: READ SH,X
    ,Y: DRAW SH AT X,Y: NEXT : IF
     PEEK (787) <  > 169 THEN  FOR
    I = 768 TO 815: READ C: POKE
    I,C: NEXT : POKE 10,76: POKE
    11,0: POKE 12,3
10025  DATA 25,0,10,16,10,10,23,2
    0,10,24,30,10,17,40,10
10030  DATA 20,120,10,21,130,10,1
    9,140,10,20,150,10,25,170,10
    ,16,180,10,23,190,10,24,200,
    10,17,210,10
10035  DATA 18,225,185,26,235,185
    ,17,245,185,22,255,185
10040  DATA 32,12,225,172,161,0,1
    73,160,0,32,168,252,173,48,1
    92,136,208,244,96,169,0,133,
    0,169,32,133,1,160,133,.77,0
    ,73,255,145,0,230,0,208,246,
    230,1,165,1,41,31,208,238,96

10045  FOR I = 0 TO 4: HPLOT I,14
     TO I,191: HPLOT 0,14 + I TO
    218,14 + I: HPLOT 214 + I,14
     TO 214 + I,191: NEXT
10050  HPLOT 240,170 TO 240,30 TO
    241,30 TO 241,170: HPLOT 249
    ,170 TO 249,30 TO 250,30 TO
    250,170: HPLOT 237,171 TO 25
    3,171 TO 253,172 TO 237,172
10055  FOR I = 35 TO 155 STEP 15:
     HPLOT 239,I: HPLOT 251,I: NEXT

10060  POKE  - 16304,0: POKE  - 1
    6302,0: POKE  - 16300,0
10065 YX = 10:YY = 16: FOR I = 0 TO
    4:X%(I) = I * 4 + 2:Y%(I) =
    2: NEXT
10070 SC = 0:TS = 0:FL = 130:FC =
    0:IN =  - 1
10075  DRAW 10 AT 55,10: IF HS =
    0 THEN  DRAW 10 AT 225,10
10080  IF HS > 0 THEN  GOSUB 765
10085  DRAW 11 AT YX * 10,YY * 10
     + 30:A%(YX,YY) = 11: FOR I =
    0 TO 4: DRAW 12 AT X%(I) * 1
    0,Y%(I) * 10 + 30:A%(X%(I),Y
    %(I)) = 12: NEXT
10090 Z =  USR (7300):Z =  USR (6
    300):Z =  USR (8000):Z =  USR
    (6300):Z =  USR (8000):Z =  USR
    (9150)
10095 QQ = 19: HCOLOR= 6: FOR I =
    0 TO FL: HPLOT 242,170 - I TO
    248,170 - I
10100  IF I / 7 =  INT (I / 7) THEN
    Z =  USR (256 * QQ + 30):QQ =
    QQ - 1
10110  NEXT : HCOLOR= 3:Z =  USR
    (8000): RETURN
```


● Circle No. 189

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by Mike Todd

Telephone monitor

WITH TELEPHONE charges as high as they are, it is useful to be able to keep an eye on the cost of a call as it is being made. Michael Gerrard of Slough has written this useful program which monitors the progress of the call, displaying its time and cost.

The program is designed for use on the Pet, but will also work with a Commodore 64. First ask it for the type of call being made — local, up to 56km., etc. — and the charging rate — cheap, standard or peak. The screen then displays all the necessary information, including the number of units used, and the cost so far, including VAT.

There is a timer shown at the bottom right of the screen which shows how much of the current unit is remaining, so that a call can be terminated just before the cost of the next unit is incurred.

All the current charges for calls to the U.K. and Eire are included in Data statements in lines 210 to 250, and lines 185 and 190 hold the current VAT rate and unit charge, all of which are easily changed when phone charges rise. At the end of every unit, a bell sounds.

The only drawback of the program is the time and effort needed to laod it before every phone call, but if a number of expensive calls are made, then it is well worthwhile. There is scope for development of such a program, including the addition of a facility to log the details of each call on cassette, disc or printer once the call is complete. I would also like to see something like this written in machine code and put into a ROM so that it is available at all times with a minimum of keystrokes.

```
100 REM*********************************
110 REM*                               *
120 REM* TELEPHONE CHARGE PROGRAM      *
130 REM* (C) M GERRARD  1983           *
140 REM*                               *
150 REM*********************************
160 REM* DATA TABLE SHOWING TIME       *
170 REM* (IN SECS) OF ONE UNIT:        *
180 REM*********************************
185 DATA          15       :REM* VAT %
190 DATA          4.4      :REM* UNIT COST
200 REM CHEAP,STAND, PEAK UNIT LENGTH
210 DATA  480,  120,   90:REM* LOCAL
220 DATA  144,   45,   30:REM* AREA A
230 DATA   48,   16,   12:REM* AREA B
240 DATA   60,   20,   15:REM* AREA B1
250 DATA   15,    8,    8:REM* TO EIRE

300 REM** READ ARRAY
310 READ TAX,U
320 DIMC(5,3)
330 FOR X=1TO5:FOR Y=1TO3
340 READ C(X,Y)
350 NEXT Y:NEXT X

400 REM** INPUT DETAILS OF CALL
410 PRINT"■PLEASE GIVE DETAILS OF CALL TO BE COSTED":RESTORE:READTAX,U
420 PRINT:PRINT:PRINT"TYPE OF CALL:"
430 PRINT:PRINT"              L) LOCAL CALL
440 PRINT:PRINT"              A) CALLS UP TO 56KM (35 M)"
450 PRINT:PRINT"              B) CALLS OVER 56KM (35 M)"
460 PRINT:PRINT"              C) OVER 56KM-LOW COST ROUTE";
470 PRINT:PRINT"              I) TO IRISH REPUBLIC"
480 PRINT:PRINT"              O) OTHER."
490 GETA$:IFA$="L"THENX=1:GOTO600
500 IFA$="A"THENX=2:GOTO600
510 IFA$="B"THENX=3:GOTO600
520 IFA$="C"THENX=4:GOTO600
530 IFA$="I"THENX=5:GOTO600
540 IFA$="O"THENX=C:Y=0:GOTO560
550 GOTO490
560 INPUT"■LENGTH OF EACH UNIT (IN SECONDS)";C(0,0)
570 PRINT:PRINT:INPUT"HOW MANY PENCE IS EACH UNIT      ";U
580 GOTO700
600 PRINT:PRINT"CHARGE RATE :"
610 PRINT:PRINT"              C) CHEAP     (6PM-8AM & W/E)";
620 PRINT:PRINT"              S) STANDARD (1PM-6AM,8-9AM)";
630 PRINT:PRINT"              P) PEAK      (9AM-1PM)"
640 GETB$
650 IFB$="C"THENY=1:GOTO700
660 IFB$="S"THENY=2:GOTO700
670 IFB$="P"THENY=3:GOTO700
680 GOTO640

700 PRINT"■":REM** SCREEN DISPLAY
710 PRINT"┌──────────────────────────────────────┐"
720 PRINT"│ TYPE    RATE   UNIT TIME  UNIT COST  │"
730 PRINT"│┌──────┐┌──────┐┌──────────┐┌──────────┐│"
```

(continued on next page)

● Circle No. 191

(continued from previous page)

```
740 PRINT"|  |      ||      ||         ||     '  | |"
750 PRINT"■■■"                                  '
760 PRINTTAB(4);A$;TAB(12);B$;TAB(18);C(X,Y);"SEC";TAB(30);U;"P"
770 PRINT"|  ■■■■■■■| ■■■■■■■| ■■■■■■■■■| ■■■■■■■■| |"
780 C$="|                                        |"
790 PRINTC$:PRINTC$
800 PRINT"|  TIME     UNITS      COST       VAT      |"
810 PRINT"| ■■■■■■■| ■■■■■■■| ■■■■■■■■■| ■■■■■■■■| |"
820 PRINT"|  |     0 |  |     0 |  |       0 |  |      0 | |"
830 PRINT"| ■■■■■■■| ■■■■■■■| ■■■■■■■■■| ■■■■■■■■| |"
840 PRINTC$:PRINTC$
850 PRINT"|                                 ■■■■■■■■| |"
870 PRINT"| TOTAL COST SO FAR(POUNDS)=|       0 | |"
880 PRINT"|                                 ■■■■■■■■| |"
890 PRINTC$:PRINTC$:PRINTC$
900 PRINT"|                                 ■■■■■■■■■■| |"
910 PRINT"|  AMOUNT OF UNIT REMAINING |          | |"
920 PRINT"|                                 ■■■■■■■■■■| |"
930 PRINTC$
940 PRINT"|  NOW DIAL & PRESS A KEY WHEN ANSWERED |"
950 PRINT"■■■■■■■■■■
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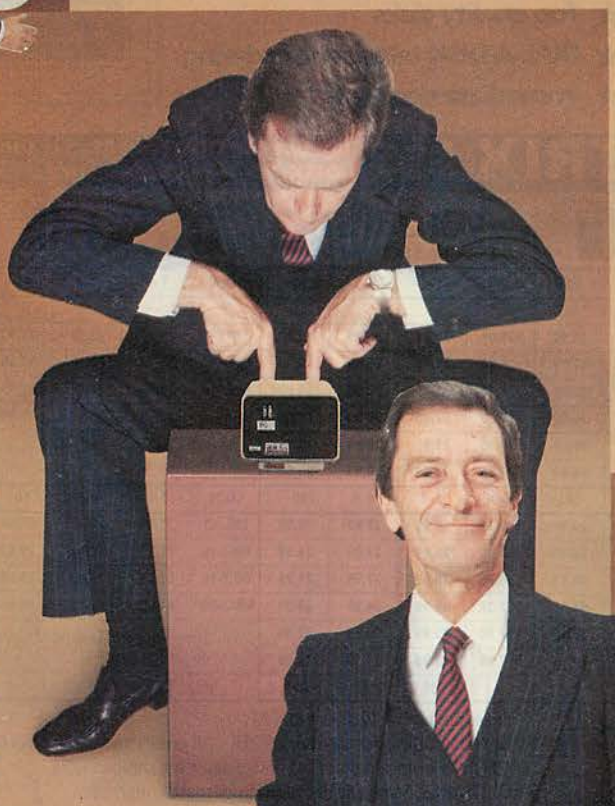

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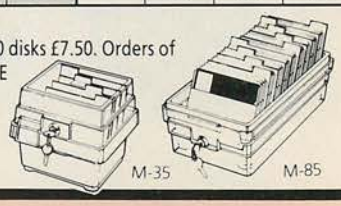

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Extra characters

LIKE MANY of us, Mr Magnus Davidson of Inverness has felt the need for more than the normal 21 user-definable characters. After looking hard at the graphics-handling routines in the Spectrum he has come up with a technique to generate extra characters.

It uses the system variable Chars, which contains a number 256 less than the address of the character data in the memory. Characters in ROM start at address 15616, so it normally contains the number 15360. By making the variable Chars point to an address in RAM the whole set can be defined.

which puts this technique to use by allowing you to edit, manipulate and store entire character sets. A magenta cursor appears in the lower left of the screen and you are offered the following options:

T — Transfers normal character set to RAM
D — Displays character pattern
S — Stores character pattern
E — Allows editing of character pattern
C — Clears pattern display
R — Records character set on to tape
L — Loads previously stored character set from tape
P — allows editing of picture pattern of the screen
W — Wipes picture pattern clear
$ — Prints present set on ZX printer
£ — Prints present picture on ZX printer
U — Loads only the 21 user-defined graphics previously prepared
X — Records on tape only the user-defined graphics
Q — Quits the program

On the screen, the normal character set is displayed in red, indicating what character must be typed to obtain the defined character in blue beneath it. To obtain user-defined graphics A to U you must use graphics mode. To edit you move the flashing cursor using the unshifted cursor keys. A swuare is set by typing S and reset with R. Having defined the pattern, you press Enter to bring back the magenta cursor, and any of the main commands can now be used.

Picture editing works in exactly the same way except that when S is pressed the program asks what character is to be placed there. The bytes making up the character are displayed for reference. When the program has recorded the set or the user-defined graphics on tape, it automatically verifies the data.

In a 16K machine the defined sets are stored at address 31832 so a program using the defined characters must first Clear 31831 to protect the memory. The value of Chars must be altered by Poke 23606,88:Poke 23607,123. To revert to the standard set, Poke 23606,0:Poke 23607,60. If you wish you can toggle between the defined and standard character set by switching Pokes.

As Mr Davidson says, the best way of exploiting this program to the full is to play around with it until you have mastered the way it works.

```
  0 >REM CHARACTER SET GENERATOR
          & M.DAVIDSON 1983
  10 CLEAR 31831
  20 GO SUB 1058
  40 GO SUB 1028
  99 REM MAIN PROGRAM
 100 GO SUB 1004: PRINT AT 21,0;
 FLASH 1; INK 3;">"
 102 LET Z$=INKEY$: IF Z$="" THE
N GO TO 102
 104 PRINT AT 21,0;" ": IF Z$>="
A" AND Z$<="Z" THEN LET Z$=CHR$
(CODE Z$+32)
 106 IF Z$="c" THEN GO SUB 1084
 108 IF Z$="d" THEN GO SUB 1034:
 GO SUB 1044
 110 IF Z$="s" THEN GO SUB 1034:
 GO SUB 1004: GO SUB 1052: GO SU
B 1020
 112 IF Z$="r" THEN GO SUB 1088
 114 IF Z$="l" THEN GO SUB 1096
 116 IF Z$="t" THEN GO SUB 1000:
 GO SUB 1006
 118 IF Z$="e" THEN GO SUB 1064
 120 IF Z$="p" THEN GO SUB 1106
 122 IF Z$="w" THEN GO SUB 1130
 124 IF Z$="#" THEN GO SUB 1136
 126 IF Z$="$" THEN GO SUB 1138
 128 IF Z$="u" THEN GO SUB 1144
 130 IF Z$="x" THEN GO SUB 1146
 148 IF Z$="q" THEN STOP
 150 BEEP .1,10: GO TO 100
 999 REM CHARS TO RAM
1000 FOR N=0 TO 768: POKE RAM+N,
PEEK (ROM+N): NEXT N: RETURN
1001 REM POINT TO RAM
1002 POKE CHARS,88: POKE CHARS+1
,123: RETURN
1003 REM POINT TO ROM
1004 POKE CHARS,0: POKE CHARS+1,
60: RETURN
1005 REM PRINT OUT CHARS
1006 FOR A=32 TO 127 STEP 32
1008 GO SUB 1004: FOR B=A TO A+3
1
1010 PRINT AT A/16,B-A; INK 2;CH
R$ B: NEXT B
1012 GO SUB 1002: FOR B=A TO A+3
1
1014 PRINT AT A/16+1,B-A; INK 1;
CHR$ B: NEXT B: NEXT A
1016 GO SUB 1004: PRINT AT 8,0;
INK 2;"UDG'S : ": FOR A=65 TO 85
1018 PRINT AT 8,A-57; INK 2;CHR$
 A;AT 9,A-57; INK 1;CHR$ (A+79):
 NEXT A: RETURN
1019 REM PLOT CHAR ON LIST
1020 IF C<128 THEN LET Y=INT (C/
32)*2+1: LET X=(C/32-INT (C/32))
*32: GO TO 1024
1022 LET Y=9: LET X=C-136
1024 GO SUB 1002: PRINT AT Y,X;
INK 1;CHR$ C: GO SUB 1004: RETUR
N
1025 REM SQUARES
1026 DRAW 65,0: DRAW 0,-65: DRAW
 -65,0: DRAW 0,65: RETURN
1027 REM SCREEN
1028 INK 0: PAPER 7: BORDER 6: C
LS : PRINT TAB 4; BRIGHT 1;"CHAR
ACTER SET GENERATOR"
1030 GO SUB 1006: PLOT 39,88: GO
 SUB 1026: PLOT 159,88: GO SUB 1
026
1032 PRINT AT 20,4;"PICT.BUILD";
AT 20,19;"CHAR.BUILD": RETURN
1033 REM GET CHAR
1034 GO SUB 1004: INPUT "CHARACT
ER :"; LINE C$: LET C=CODE C$
1036 IF C<32 OR (C>127 AND C<144
) OR C>164 THEN GO TO 1034
1038 IF C<128 THEN LET MEM=RAM+(
C-32)*8
1040 IF C>143 THEN LET MEM=USR C
$
1042 GO SUB 1002: RETURN
1043 REM WRITE CHAR
1044 FOR A=MEM TO MEM+7: LET P=P
EEK A: FOR B=8 TO 1 STEP -1
1046 INK 0: PAPER 7: IF P>=D(B)
THEN LET P=P-D(B): PAPER 0: INK
7
1048 PRINT AT A+11-MEM,28-B;" "
1050 NEXT B: NEXT A: PAPER 7: IN
K 0: RETURN
1051 REM READ CHAR
1052 FOR A=MEM TO MEM+7: LET P=0
: FOR B=8 TO 1 STEP -1
1054 IF ATTR (A+11-MEM,28-B)=7 T
HEN LET P=P+D(B)
1056 NEXT B: POKE A,P: LET T$=ST
R$ P+" ": PRINT AT A+11-MEM,14;
T$: NEXT A: RETURN
```

(continued on next page)

(continued from previous page)

```
1057 REM INITIALISE
1058 DIM P$(8,8): DIM D(8)
1060 LET RAM=31832: LET ROM=1561
6: LET CHARS=23606
1062 FOR N=0 TO 7: LET D(N+1)=2↑
N: NEXT N: RETURN
1063 REM CHAR EDIT
1064 LET X=0: LET Y=0
1066 PRINT AT Y+11,X+20; FLASH 1
; INK 8; PAPER 8;" "
1068 PAUSE 10
1070 LET A$=INKEY$: IF A$="" THE
N GO TO 1068
1072 IF A$="S" OR A$="s" THEN PR
INT AT Y+11,X+20; FLASH 1; INK 7
; PAPER 0;" "
1074 IF A$="R" OR A$="r" THEN PR
INT AT Y+11,X+20; FLASH 1; INK 0
; PAPER 7;" "
1076 PRINT AT Y+11,X+20; FLASH 0
; INK 8; PAPER 8;" "
1078 IF CODE A$=13 THEN RETURN
1080 LET X=X+(A$="8")-(A$="5"):
LET Y=Y+(A$="6")-(A$="7")
1082 LET Y=Y+(Y<0)-(Y>7): LET X=
X+(X<0)-(X>7): GO TO 1066
1083 REM CLEAR CHAR
1084 FOR A=0 TO 7: FOR B=0 TO 7
1086 PRINT AT A+11,B+20; INK 0;
PAPER 7;" ": NEXT B: NEXT A: RET
URN
1087 REM SAVE SET
1088 GO SUB 1102
1090 SAVE F$CODE 31832,936
1092 VERIFY F$CODE 31832,936
1094 GO SUB 1028: RETURN
1095 REM LOAD SET
1096 GO SUB 1102
1098 LOAD F$CODE 31832,936
1100 GO SUB 1028: RETURN
1101 REM GET FILENAME
1102 INPUT "FILENAME:"; LINE F$:
 IF LEN F$>10 THEN GO TO 1102
1104 RETURN
1105 REM PICTURE EDIT
1106 LET X=0: LET Y=0
1108 PRINT OVER 1; FLASH 1;AT Y+
11,X+5;" ": PAUSE 20
1110 LET A$=INKEY$: IF A$="" THE
N GO TO 1110
1112 IF A$="S" OR A$="s" THEN GO
 SUB 1126
1114 IF A$="R" OR A$="r" THEN PR
INT FLASH 1;AT Y+11,X+5;" ": LET
 P$(Y+1,X+1)=" "
1116 PRINT OVER 1;AT Y+11,X+5;"
"
1118 IF CODE A$=13 THEN RETURN
1120 LET Y=Y+(A$="6")-(A$="7"):
LET Y=Y+(Y<0)-(Y>7)
1122 LET X=X+(A$="8")-(A$="5"):
LET X=X+(X<0)-(X>7)
1124 GO TO 1108
1125 REM PLOT CHAR
1126 GO SUB 1002: GO SUB 1034: P
RINT AT Y+11,X+5; FLASH 1;CHR$ C
: GO SUB 1004
1128 LET P$(Y+1,X+1)=CHR$ C: RET
URN
1129 REM WIPE PICTURE
1130 FOR A=0 TO 7: FOR B=0 TO 7
1132 PRINT AT B+11,A+5;" ": LET
P$(B+1,A+1)=" "
1134 NEXT B: NEXT A: RETURN
1135 REM PRINT PICTURE
1136 GO SUB 1002: FOR N=1 TO 8:
LPRINT TAB 12;P$(N): NEXT N: GO
SUB 1004: RETURN
1137 REM PRINT CHAR SET
1138 GO SUB 1002: FOR N=32 TO 12
7: LPRINT CHR$ N;: NEXT N
1140 FOR N=144 TO 164: LPRINT TA
B N-139;CHR$ N;: NEXT N: LPRINT
1142 GO SUB 1004: RETURN
1143 REM LOAD UDG'S
1144 GO SUB 1102: LOAD F$CODE US
R "A",168: GO SUB 1028: RETURN
1145 REM SAVE UDG'S
1146 GO SUB 1102: SAVE F$CODE US
R "A",168
1148 VERIFY F$CODE USR "A",168:
GO SUB 1028: RETURN
9999 PRINT PEEK 23730+256*PEEK 2
3731-PEEK 23653-256*PEEK 23654
```

Four in One.

```
  10 PRINT "  THE OBJECT OF THE
GAME IS TO ": PRINT "GET 4 SQUAR
ES OF YOUR OWN COLOUR": PRINT "I
N A ROW. THIS MAY BE HORIZONTALO
RTICAL OR DIAGONAL.  "
  20 PRINT ,,,,"RED ALWAYS START
S FIRST"
  30 PRINT ,,,,"SELECT COLUMN 0
TO STOP GAME": PRINT "WHEN A PLA
YER HAS WON"
  40 PRINT ,,,,"TYPE ANY KEY TO
START"
  50 IF INKEY$<>"" THEN GO TO 70
  60 GO TO 50
  70 CLS : CLEAR
  80 DIM C(8)
  90 FOR N=1 TO 8: LET C(N)=0: N
EXT N
 100 REM  * PRINT MATRIX *
 110 FOR N=0 TO 5
 120 PRINT AT 18-(N*3),1;N+1
 130 NEXT N
 140 FOR N=0 TO 7
 150 PRINT AT 21,(5+N*3);N+1
 160 NEXT N
 170 FOR N=1 TO 48
 180 INPUT "PLEASE SELECT COLUMN
";C$
 190 IF CODE C$>96 AND CODE C$<1
23 THEN GO TO 180
 200 LET COLUMN=VAL (C$)
 210 IF COLUMN>8 THEN GO TO 180
 220 IF COLUMN=0 THEN GO TO 320
 230 FOR I=0 TO 1
 240 IF INT (N/2)<>N/2 THEN LET
P=1: GO TO 260
 250 LET P=0
 260 REM  * PRINT SQUARES *
 270 IF C(COLUMN)=6 THEN GO TO 1
80
 280 PRINT AT 18-(C(COLUMN)*3)-I
,2+COLUMN*3; PAPER P+1;"  "
 290 NEXT I
 300 LET C(COLUMN)=C(COLUMN)+1
 310 NEXT N
 315 GO TO 340
 320 IF P=1 THEN PRINT AT 0,1; F
LASH 1;"RED HAS WON": GO TO 340
 330 PRINT AT 0,1; FLASH 1;"BLUE
 HAS WON"
 340 INPUT "PRESS M TO PLAY AGAI
N, ANY OTHER KEY TO STOP",I$
 350 IF I$="m" THEN GO TO 70
 360 STOP
```

Four in One

Charles Cowan has sent in a strategy-type game for two players called Four in One. Each player selects a colour, either red or blue, and takes a turn in placing a square of a chosen colour in one of eight columns, which are filled from the bottom of the screen. The winner is the first player to make a vertical, horizontal or diagonal line of four squares of the chosen colour. The game may end in a draw if neither succeeds.

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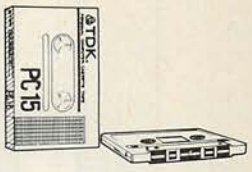

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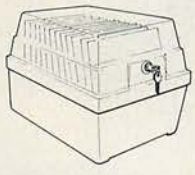

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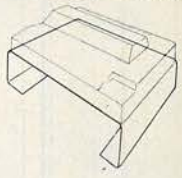

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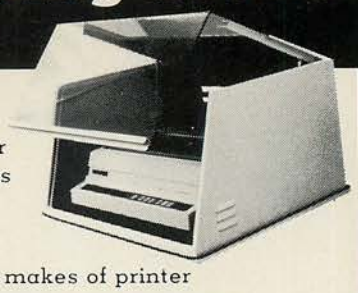

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by Ian Stobie

Disc copier

CP/M'S PIP utility is the standard means of copying from one disc to another. This program by Dave Lane of Herne Bay Secondary School in Kent provides an improved alternative when you want to copy the entire side of a disc. Its advantages are that it is faster, performs error checking, copies everything including CP/M, and automatically initialises the drive, eliminating the annoying Read Only error which careless use of Pip can give.

Each disc sector is checked for Read and Write errors and all are reported, although execution continues regardless. Copying a disc surface on to itself is therefore permitted and performs a useful verification function.

To assemble the program use the following procedure, which assumes that the disc in drive A has on it CP/M, TXED, ZASM, and the CP/M program Load. Load TXED and create the source text file using

A>TXED DSKCPY.ZSM

Type in the Assembler program from the listing, ignoring the two left-hand columns which contain hexadecimal numbers. Comments and the preceding semicolons may also be omitted. Start from ORG 100H and finish with End. Exit from TXED with

*EX$$

Load ZASM and assemble the source file

A>ZASM DSKCPY.AAA

If any errors are reported, reload TXED and correct them.

Create the machine code .COM file with

A>LOAD DSKCPY

There are now a multitude of DSKCPY files on the disc. DSKCPY.COM is the end result. It is executed by typing:

A>DSKCPY

```
A>TYPE DSKCPY.PRN
                ;DSKCPY   D.LANE   H.B.S.S.   1983
                ;RML 380Z MDS (or FDS)    COS 3.4M

  0100                  ORG 100H
                ;calls to monitor
  000D =        CR      EQU 0DH
  0019 =        INIT    EQU 19H
  001A =        RDSEC   EQU 1AH
  001C =        WRCHK   EQU 1CH
  1000 =        BADD    EQU 1000H
  0017 =        MSG     EQU 17H
  0021 =        KBDW    EQU 21H
  0001 =        OUTC    EQU 01H
  0013 =        GETHEX  EQU 13H
  0015 =        BYTEO   EQU 15H
  0100 C33602           JP START
                ;disk controls blocks used by RDSEC & WRCHK
  0103 00       RUNIT:  00H
  0104 00       RTRACK: 00H
  0105 00       RSECT:  00H
  0106 0000     RADDR:  00H,00H
  0108 00       WUNIT:  00H
  0109 00       WTRACK: 00H
  010A 00       WSECT:  00H
  010B 0000     WADDR:  00H,00H
                ;output store used by BYTEO
  010D 000080   HEXOUT: 00H,00H,80H
                ;messages
  0110 5741524E M0:'WARNING - overwrites destination disk',80H
  0136 4469736B M1:'Disk Copy. D.Lane. H.B.S.S',80H
  0151 536F7572 M2:'Source Drive ? ',80H
  0161 44657374 M3:'Destination Drive ? ',80H
  0176 496E7365 M4:'Insert Disks then press RETURN ',80H
  0196 52656164 M5:'Read Error... ',80H
  01A5 57726974 M6:'Write Error.. ',80H
  01B4 436F7079 M7:'Copy complete ',80H
  01C3 44726976 M8:'Drive ',80H
  01CA 436F7079 M9:'Copying....',80H
  01D6 54726163 M10:'Track....',80H
  01E0 20536563 M11:' Sector ',80H
                ;error messages
  01E9 57726974 E6:'Write protect',80H
  01F7 57726974 E5:'Write fault',80H
  0203 5265636F E4:'Record not found',80H
  0214 43524320 E3:'CRC error',80H
  021E 44617461 E2:'Data lost',80H
  0228 44617461 E1:'Data mismatch',80H
  0236 213601   START:  LD HL,M1
  0239 F717             EMT MSG
  023B 3E0D             LD A,CR
  023D F701             EMT OUTC
  023F 211001           LD HL,M0
  0242 F717             EMT MSG
  0244 3E0D             LD A,CR
  0246 F701             EMT OUTC
  0248 215101   SOURCE: LD HL,M2        ;get source drive
  024B F717             EMT MSG
  024D F713             EMT GETHEX
  024F 3E0D             LD A,CR
  0251 F701             EMT OUTC
  0253 7D               LD A,L          ;check valid
  0254 D60A             SUB 0AH
  0256 320301           LD (RUNIT),A
  0259 FE04             CP 04H          ;bad...retry
  025B 30EB             JR NC,SOURCE
  025D C641             ADD 41H
  025F 21C301           LD HL,M8
  0262 F717             EMT MSG
  0264 F701             EMT OUTC
  0266 3E0D             LD A,CR
  0268 F701             EMT OUTC
  026A 216101   DEST:   LD HL,M3        ;get dest. drive
  026D F717             EMT MSG
  026F F713             EMT GETHEX
  0271 3E0D             LD A,CR
  0273 F701             EMT OUTC
  0275 7D               LD A,L          ;check valid
  0276 D60A             SUB 0AH
  0278 320B01           LD (WUNIT),A
  027B FE04             CP 04H          ;bad...retry
  027D 30EB             JR NC,DEST
  027F C641             ADD 41H
  0281 21C301           LD HL,M8
  0284 F717             EMT MSG
  0286 F701             EMT OUTC
  0288 3E0D             LD A,CR
  028A F701             EMT OUTC
  028C 217601   INDSK:  LD HL,M4        ;insert disks
  028F F717             EMT MSG
  0291 3E0D             LD A,CR
  0293 F701             EMT OUTC
  0295 F721     GETCR:  EMT KBDW
  0297 FE0D             CP 0DH
  0299 20FA             JR NZ,GETCR
  029B DD210301         LD IX,RUNIT     ;initialise rdrive
  029F F719             EMT INIT
  02A1 FE00             CP 0H
  02A3 20E7             JR NZ,INDSK     ;error
  02A5 DD210B01         LD IX,WUNIT     ;initialise wdrive
  02A9 F719             EMT INIT
  02AB FE00             CP 0H
  02AD 20DD             JR NZ,INDSK     ;error
                ;copying routine follows
  02AF 21CA01           LD HL,M9
  02B2 F717             EMT MSG
  02B4 3E0D             LD A,CR
  02B6 F701             EMT OUTC
  02B8 0600             LD B,00H
  02BA 78       NXTTRK: LD A,B          ;display track
  02BB 210D01           LD HL,HEXOUT
  02BE F715             EMT BYTEO
  02C0 21D601           LD HL,M10
  02C3 F717             EMT MSG
  02C5 210D01           LD HL,HEXOUT
  02C8 F717             EMT MSG
  02CA 3E0D             LD A,CR
  02CC F701             EMT OUTC
  02CE 110010           LD DE,BADD      ;read sector
  02D1 0E01             LD C,01H
  02D3 78       NXTRS:  LD A,B
  02D4 320401           LD (RTRACK),A
  02D7 79               LD A,C
  02D8 320501           LD (RSECT),A
  02DB ED530601         LD (RADDR),DE
  02DF DD210301         LD IX,RUNIT
  02E3 F71A             EMT RDSEC
  02E5 FE00             CP 00H          ;any errors?
  02E7 2808             JR Z,ROKAY
  02E9 219601           LD HL,M5        ;'READ' error
  02EC F717             EMT MSG
  02EE CD3B03           CALL ERROR      ;report type & sector
  02F1 210001   ROKAY:  LD HL,100H
  02F4 19               ADD HL,DE
  02F5 EB               EX DE,HL
  02F6 0C               INC C
  02F7 79               LD A,C
  02F8 FE11             CP 11H
  02FA 20D7             JR NZ,NXTRS     ;next sector
  02FC 110010           LD DE,BADD      ;write sector
  02FF 0E01             LD C,01H
  0301 78       NXTWS:  LD A,B
  0302 320901           LD (WTRACK),A
  0305 79               LD A,C
  0306 320A01           LD (WSECT),A
  0309 ED530B01         LD (WADDR),DE
  030D DD210801         LD IX,WUNIT
  0311 F71C             EMT WRCHK
  0313 FE00             CP 00H          ;any errors?
```

(continued on next page)

(continued from previous page)

```
0315 2808              JR Z,WOKAY
0317 21A501            LD HL,M6          ;'WRITE' error
031A F717              EMT MSG
031C CD3B03            CALL ERROR        ;report type & sector
031F 210001    WOKAY:  LD HL,100H
0322 19                ADD HL,DE
0323 EB                EX DE,HL
0324 0C                INC C
0325 79                LD A,C
0326 FE11              CP 11H            ;( or 1BH on FDS )
0328 20D7              JR NZ,NXTWS       ;next sector
032A 04                INC B
032B 78                LD A,B
032C FE28              CP 28H            ;( or 4DH on FDS )
032E C2BA02            JP NZ,NXTTRK      ;do next track
0331 21B401            LD HL,M7          ;all done
0334 F717              EMT MSG
0336 3E0D              LD A,CR
0338 F701              EMT OUTC
033A C9                RET               ;back to CP/M
033B CB77      ERROR:  BIT 6,A           ;identify error
033D 2803              JR Z,B5
033F 21E901            LD HL,E6
0342 CB6F      B5:     BIT 5,A
0344 2803              JR Z,B4
0346 21F701            LD HL,E5
0349 CB67      B4:     BIT 4,A
034B 2803              JR Z,B3
034D 210302            LD HL,E4
0350 CB5F      B3:     BIT 3,A
0352 2803              JR Z,B2
0354 211402            LD HL,E3
0357 CB57      B2:     BIT 2,A
0359 2803              JR Z,B1
035B 211E02            LD HL,E2
035E CB4F      B1:     BIT 1,A
0360 2803              JR Z,REPORT
0362 212802            LD HL,E1
0365 F717      REPORT: EMT MSG           ;display error type
0367 21E001            LD HL,M11
036A F717              EMT MSG
036C 79                LD A,C            ;and sector
036D 210D01            LD HL,HEXOUT
0370 F715              EMT BYTEO
0372 210D01            LD HL,HEXOUT
0375 F717              EMT MSG
0377 3E0D              LD A,CR
0379 F701              EMT OUTC
037B C9                RET
0000           END
```

```
035E B1      0357 B2      0350 B3      0349 B4      0342 B5
1000 BADD    0015 BYTEO   000D CR      026A DEST    0228 E1
021E E2      0214 E3      0203 E4      01F7 E5      01E9 E6
033B ERROR   0295 GETCR   0013 GETHEX  010D HEXOUT  028C INDSK
0019 INIT    0021 KBDW    0110 M0      0136 M1      01D6 M10
01E0 M11     0151 M2      0161 M3      0176 M4      0196 M5
01A5 M6      01B4 M7      01C3 M8      01CA M9      0017 MSG
02D3 NXTRS   02BA NXTTRK  0301 NXTWS   0001 OUTC    0106 RADDR
001A RDSEC   0365 REPORT  02F1 ROKAY   0105 RSECT   0104 RTRACK
0103 RUNIT   0248 SOURCE  0236 START   010B WADDR   031F WOKAY
001C WRCHK   010A WSECT   0109 WTRACK  0108 WUNIT
No errors
```

Plotting.

```
C>TYPE GOBLET.BAS
10 REM GOBLET -- BY DANIEL FREEMAN (A 3D GRAPHICS PROGRAM.)
20 PUT 12
30 FOR Q=1 TO 9
40 READ X(Q),Y(Q)
50 NEXT Q
60 FOR B=2 TO 100
70 CALL"RESOLUTION",0,0
80 CALL"OFFSET",-160,-50
90 FOR C=1 TO 9
100 LET A$="PLOT"
110 FOR D=0 TO 7.854 STEP 6.283/B
120 CALLA$,X(C)*COS(D),Y(C)+X(C)*0.2*SIN(D),1
130 LET A$="LINE"
140 IF C=1 THEN NEXT D,C
150 CALL"PLOT",X(C-1)*COS(D),Y(C-1)+X(C-1)*0.2*SIN(D),1
160 CALL"LINE",X(C)*COS(D),Y(C)+X(C)*0.2*SIN(D),1
170 NEXT D
180 NEXT C
190 NEXT B
200 DATA 50,0,50,10,5,10,5,40,40,40,75,100,65,100,30,45,0,45
```

```
C>TYPE GOBLET2.BAS
10 REM GOBLET2 -- BY DANIEL FREEMAN (A 3D GRAPHICS PROGRAM.)
20 PUT 12
30 FOR Q=1 TO 9
40 READ X(Q),Y(Q)
50 NEXT Q
60 INPUT"NUMBER OF SIDES";B
70 CALL"RESOLUTION",0,0
80 CALL"OFFSET",-160,-50
90 FOR G=0 TO 6.3 STEP 0.1
100 CALL"DISPLAY",0,G*10
110 CALL"UPDATE",0,G*10-1
120 CALL"FILL",-76,-20,75,120,0
130 FOR C=1 TO 9
140 LET A$="PLOT"
150 FOR D=0 TO 7.854 STEP 6.283/B
160 CALLA$,X(C)*COS(D+G),Y(C)+X(C)*0.2*SIN(D+G),1
170 LET A$="LINE"
180 IF C=1 THEN NEXT D,C
190 CALL"PLOT",X(C-1)*COS(D+G),Y(C-1)+X(C-1)*0.2*SIN(D+G),1
200 CALL"LINE",X(C)*COS(D+G),Y(C)+X(C)*0.2*SIN(D+G),1
210 NEXT D
220 NEXT C
230 NEXT G
240 GOTO 90
250 DATA 50,0,50,10,5,10,5,40,40,40,75,100,65,100,30,45,0,45

C>
```

```
TYPE GOBLET3.BAS
10 REM GOBLET3 -- BY DANIEL FREEMAN (A 3D GRAPHICS PROGRAM.)
20 PUT 12
30 FOR Q=1 TO 9
40 READ X(Q),Y(Q)
50 NEXT Q
60 INPUT"STEPPING BY";B
70 CALL"RESOLUTION",0,0
80 CALL"OFFSET",-160,-50
90 FOR G=0 TO 6.2 STEP B
100 FOR C=1 TO 9
110 LET A$="PLOT"
120 FOR D=0 TO 7.854 STEP 6.283
130 CALLA$,X(C)*COS(D+G),Y(C)+X(C)*0.2*SIN(D+G),1
140 LET A$="LINE"
150 IF C=1 THEN NEXT D,C
160 CALL"PLOT",X(C-1)*COS(D+G),Y(C-1)+X(C-1)*0.2*SIN(D+G),1
170 CALL"LINE",X(C)*COS(D+G),Y(C)+X(C)*0.2*SIN(D+G),1
180 NEXT D
190 NEXT C
200 NEXT G
210 DATA 50,0,50,10,5,10,5,40,40,40,75,100,65,100,30,45,0,45
```

```
C>TYPE GOBLET4.BAS
10 REM GOBLET3 -- BY DANIEL FREEMAN (A 3D GRAPHICS PROGRAM.)
20 PUT 12
30 FOR Q=1 TO 9
40 READ X(Q),Y(Q)
50 NEXT Q
60 LET I=1
70 CALL"RESOLUTION",0,2
80 CALL"OFFSET",-160,-50
90 FOR G=0 TO 6.2 STEP .1
100 FOR C=1 TO 9
110 LET A$="PLOT"
120 FOR D=0 TO 7.854 STEP 6.283
130 CALLA$,X(C)*COS(D+G),Y(C)+X(C)*0.2*SIN(D+G),I
140 LET A$="LINE"
150 IF C=1 THEN NEXT D,C
160 CALL"PLOT",X(C-1)*COS(D+G),Y(C-1)+X(C-1)*0.2*SIN(D+G),I
170 CALL"LINE",X(C)*COS(D+G),Y(C)+X(C)*0.2*SIN(D+G),I
180 NEXT D
190 NEXT C
192 LET I=I+1
194 IF I=4 THEN LET I=1
200 NEXT G
210 DATA 50,0,50,10,5,10,5,40,40,40,75,100,65,100,30,45,0,45
220 FOR A=1 TO 3
230 CALL"COLOUR",A,255
240 LET A$=GET$(10)
250 CALL"COLOUR",A,0
260 NEXT A
270 GOTO 220

C>
```

Plotting

A suite of four programs by Daniel Freeman of Ramsgate, Kent plots the same object in a variety of different ways.

Goblet draws a flat goblet and then continues to add more sides. Goblet 2 allows you to enter the number of sides that the goblet has and then continues to draw it again, rotated by a small angle. Goblet 4 produces a rapidly rotating goblet — but give it time. The programs run on 380Z.

One-way ticket

```
5 ' * * * ONE WAY TICKET * * * BY
GEORGE SPELLER 1983
10 POKE16561,226:POKE16562,127' REM *
SET MEM SIZE AT 32738 *
20 '
30 '* 25 DATA VALUES FOR PASSING SHIPS
+ FIVE FOR MUSIC *
40
DATA187,140,157,166,140,140,140,140,153
,174,140,183,40,35,          45,70,60
50 CLEAR800:DEFINT
N,A,B,C,D,E,G,K,L,I,F,S,H
60 INPUT"GAME1 OR 2";W:IFW=0 W=2
70 '
80 '* GENERATE PASSING SHIPS AND PUT
THEM INTO STRINGS *
90 FORN=1TO6:
READA:READB:A$=A$+CHR$(A):B$=B$+CHR$(B)
:   NEXT
100
D$=STRING$(20,32):C$=STRING$(64,32):
 E$=STRING$(40,32):A$=C$+A$+D$+A$+C$:
   B$=C$+B$+E$+B$+C$
110 CR$=CHR$(187)+CHR$(140)+CHR$(183)
120 BR$=CHR$(132)+CHR$(179)+CHR$(136)
130 '
140 POKE16526,227:POKE16527,127' *
CHANGE TO DEFUSR0=32739
                * FOR DISK BASIC
150 FORN=1TO5:READXS(N):NEXT
160 GOTO1300
170 '
180 '* THIS SECTION SETS OUT THE GAME
BOARD *
190 '* GENERATES CITY SKYLINE ON
SCREEN AND MAKES INTO A STRING*
200 CLS
210 FORX=1TO127:SET(X,46):NEXT
220
FORX=1TO127:IFRND(2)=1THENSET(X,45)
230
NEXT:FORX=1TO127:IFRND(3)=1ANDPOINT(X,4
5)THENSET(X,44)
240
NEXT:FORX=1TO127:IFRND(4)=1ANDPOINT(X,4
4)THENSET(X,43)
250
NEXT:FORN=896TO1022:T$=T$+CHR$(PEEK(N+1
5360)):NEXT
260
PRINT@896,T$;:SET(127,46):SET(126,46)
270 '
280 ' * MAKE THE LANDING PLATFORM *
290
X1=RND(64)+32:FORN=1TO6:SET(X1,47-N):NE
XT
300 SET(X1-1,41):SET(X1+1,41)
310 '
320 ' * SET POSITIONS OF CROSSING
SHIPS AND LANDING CRAFT *



330 C=RND(97):D=RND(100):E=RND(92)
340 H=460:V=0:X=RND(127):G=0
350 '
360 ' * GAME LOOP STARTS HERE WITH
GRAVITATIONAL EFECT *
365 ' * PLUS MESSAGES AND SOUND *
370 V=V-1
380 PRINT@0,"FUEL
USED";G,"SPEED";V;CHR$(30);
390 K=PEEK(15359)
400 IFG)100THENPRINT@0," * FUEL OUT
*";CHR$(30);:XS=USR(1550):
XS=USR(1600):GOTO490
410 '
420 ' * INTERPRETS KEYBOARD CONTROLS
AND OPERATES BOOST *
430 IFK=96THENV=V+2:G=G+2:GOTO490
440
IFK=32THENXL=XL-.2:XR=XR/1.1:V=V+1.5:G=
G+1:GOTO490
450
IFK=64THENXR=XR+.2:XL=XL/1.1:V=V+1.5:G=
G+1:GOTO490
460
IFK=128THENV=15:H=H+100:G=G+20:FORN=760
TO550STEP-6:
XS=USR(N):NEXT:IFG)100THEN400
470 '
480 ' * MOVES LANDING CRAFT AND TESTS
FOR LANDING (OR CRASH!!) *
490 D=Y:Y=47-H/10
500 IFY)47THEN1010
510
IFD)=0ANDD(=47ANDP(127ANDP)ORESET(P,D)
520 IFY(OORX)127ORX(0THEN530
ELSEIFPOINT(X,Y)THEN1010
ELSESET(X,Y):XS=USR(768)
530 IFINT(Y)=40AND(INT(X)=X1
ORINT(X)=X1-1ORINT(X)=X1+1)THEN1130
540 H=H+V
550 P=X
560 X=X+XL:X=X+XR':IFXV)0THENXV=XV-.1
570 XL=XL*.95:XR=XR*.95
580 '
590 ' * MOVE CROSSING SHIPS *
600 C=C-2:IFC(1C=92
610 PRINT@768,MID$(A$,C,64);
620 IFW=1THENFORT=1TO75:NEXT:GOTO690
630 D=D+1:IFD)120THEND=1
640 PRINT@640,MID$(B$,D,63);
650 E=E-1:IFE(1THENE=92
660 PRINT@512,MID$(A$,E,64);
670 F=F+2:IFF)120THENF=1
680 PRINT@384,MID$(B$,F,63);
690 GOTO370
700 '
1000 ' * CRASH ROUTINE *
1010 L=(X/2+INT(Y/3)*64)-1
1020
XS=USR(520):XS=USR(530):XS=USR(509):XS=


USR(550):
XS=USR(600):XS=USR(509):IFL(1022:FORN=1
TO20:
PRINT@L,CR$;:PRINT@L,BR$;:PRINT@L,"
";:NEXT'* 3 SPACES *
1030
IFX(127ANDX)0ANDY(47ANDY)0THENRESET(X,Y
)
1040 IFY(44PRINT@L-6,"                ";'
* 12 SPACES *
1050 FORT=1TO40:NEXT:CLS
1060 PRINT@471,"YOU
CRASHED":FORT=1TO60STEP3:XS=USR(330-T):

NEXT:FORT=1TO70STEP5:XS=USR(270+T):NEXT

1070 PRINT"           YOUR SCORE
IS";ST*10;"     HIGHEST SCORE";
HS*10:PRINTTAB(19)"PRESS BAR FOR NEW
GAME"' * 10,5 SPACES *
1080 IFPEEK(15359)()128THEN1080
1090
IFPEEK(15359)()0THENXS=USR(256):GOTO109
0
1100 ST=0:SC=0:CLS:GOTO260
1110 '
1120 ' * SUCCESSFUL LANDING ROUTINE *
1130 FORN=1TO5:PRINT@0,"* * * YOU
LANDED * * *          ";
XS=USR(XS(N)):FORT=1TO20:NEXT:PRINT@0,C
HR$(30):      FORT=1TO20:NEXTT,N' * 8
SPACES *
1140 IFV=0
THENV=V-.5:SC=10*(100-G)/ABS(V):PRINT@6
,      "A PERFECT LANDING AT ZERO
VELOCITY-SCORE";SC*10:      GOTO1160
1150 SC=10*(100-G)/ABS(V):
PRINT@12,"SPEED";V;" FUEL USED";G;"
SCORE";SC*10
1160 ST=ST+SC:SC=0:      PRINT"
          TOTAL SCORE";ST*10' * 20
SPACES *
1170 IFST)HS THENHS=ST
1180 PRINT"                    PRESS BAR
FOR REPLAY"' * 17 SPACES *
1190 IFPEEK(15359)()128THEN1190
1200
PRINT@0,"";:FORN=1TO3:PRINTCHR$(30):NEX
T
1210 ST=ST+SC:SC=0:RESET(X,Y)
1220 IFPEEK(15359)()0
THENXS=USR(256):GOTO1220
1230 FORT=1TO100:NEXT
1240 GOTO340
1300 CLS:PRINT@13,"* * * * ONE WAY
TICKET * * * *"
1310 PRINT"YOU HAVE LEFT YOUR ORBITING
SPACESHIP AND ARE IN"
1311 PRINT"A LANDING SHUTTLE. YOU HAVE
TWO RETRO ROCKETS,"


1312 PRINT"ONE ON EACH SIDE, WHICH
FIRE AT AN ANGLE."
1313 PRINT"USE THEM SINGLY TO GET SIDE
THRUST AND SOME LIFT,"
1314 PRINT"OR TOGETHER TO GIVE
UPTHRUST ONLY. USE THE LEFT"
1315 PRINT"AND RIGHT ARROW KEYS TO
CONTROL THEM."
1316 PRINT"YOU MUST LAND YOUR SHIP
WITH LEAST SPEED AND"
1317 PRINT"LEAST FUEL USED TO GET
MAXIMUM POINTS."
1318 PRINT"AVOID CROSSING SPACE SHIPS.
IN EMERGENCY USE"
1319 PRINT"BOOSTER (SPACE BAR).
PENALTY: 20 FUEL UNITS."
1330
FORN=0TO28:READXP:POKE32739+N,XP:NEXT
1340
DATA205,127,10,76,69,62,1,211,255,16,25
4,69,16,254,69,62,
0,211,255,16,254,69,16,254,13,194,231,1
27,201
1350 PRINT"PRESS ((ENTER)) TO
BEGIN":INPUTZ$
1360 GOTO200
```

A GRAPHIC edition of the Moon Lander game comes from Mr George Speller. It is in real time and you have to dodge other spacecraft coming in from the side. Finally, you have to finish up on a landing pad which is on top of what looks like the Post Office tower in London. There are two levels of difficulty, labelled Game 1 and Game 2.

Although it is not mentioned in the instructions, your fuel is limited to 100 units. If injudicious use of fuel sends you off the screen you can still control the craft even though you cannot see it.

Sort routine

Mr R G C Bryant of Chesham, Buckinghamshire has sent in a sort routine in Basic. Except for very short sorts of less than 50 items, Basic is very slow for this operation and a machine-language routine is necessary. Most DOSs incorporate a sort routine, so for disc users this is no problem, but we do not all have discs and to those who are deterred by the idea of incorporating machine language in their programs, I can recommend Mr Bryant's sort routine as one of the fastest I have seen in Basic.

The program includes a routine for setting up any required number of dummy items for testing purposes, which takes longer than the sort itself. Mr Bryant says that he uses it on the Model II, which is surprising since there is a good sort routine published by Tandy for TRS-DOS on the II. I tested it on the Model I and 50 items are sorted in less than 20 seconds.

Sort routine.

```
10 CLEAR 10000:CLS
60 INPUT "NUMBER TO SORT";N
70 DIM W$(N),AC(26,2),Z(N)
80 'TEST ARRAY
90 FOR R=1 TO N:FOR R1=1 TO
RND(5)+5:W$(R)=W$(R)+CHR$(RND(26)+64):N
EXT R1:PRINTR;W$(R):NEXT R
130 PRINT"STARTING SORT NOW"
140 FOR A=1 TO
N:AC=ASC(W$(A))-64:AC(AC,1)=AC(AC,1)+1:
NEXT A
150 FOR A=1 TO
26:TT=TT+AC(A,1):AC(A,2)=TT+1-AC(A,1):
NEXT
160 A=0
170 A=A+1:IF A=N+1 THEN GOTO 250
180 AC=ASC(W$(A))-64:N1=AC(AC,2):N2=N1
190 IF W$(A))W$(Z(N1-1)) THEN
Z(N1)=A:AC(AC,2)=N2+1:GOTO 170
200 Z(N1)=Z(N1-1):AC(AC,2)=N2+1
210 N1=N1-1:GOTO 190
250 CLS:FOR A=1 TO
N:PRINTW$(Z(A)):NEXT
```

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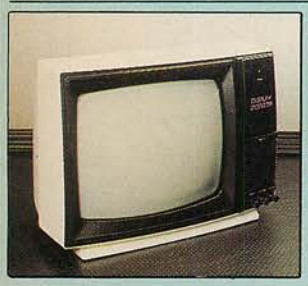

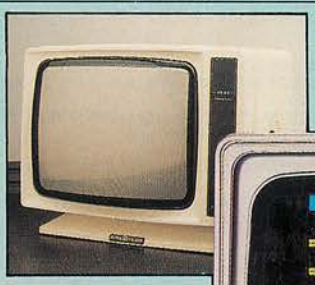

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Keeping up with Commodore

Mike Todd reviews some recently published books for Commodore computers.

OKS FOR the Commodore range of nputers are still being published more ckly than I can read them, so here is a ection of just those books published rly recently. Inevitably, books for the mmodore 64 predominate, but there are l some useful boks for the Vic-20 being oduced, and even some which are evant to the earlier range of Commodore nputers, including the Pet.

For the absolute beginner, there are five oks worth looking at, two for the Vic d three for the 64. For the Vic, Albert kler has produced *Key into your Vic-20* ich takes you from the moment you take Vic out of its box. It briefly explains ne of the hardware and software tures of the Vic and its peripherals and en goes on to explain the techniques of ogramming in Basic.

There are lots of simple example ograms covering most aspects of ogramming, including the use of ssettes, but there is only a little about und, even less about graphics and no ention of high-resolution techniques.

Strangely, having left out the more vanced graphic techniques and any cussion of the video capabilities of the , the book has a section on machine code ich jumps in at the deep end, and pears out of place in a book of this ture.

The appendices consist of the usual gurgitation of material from the *User anual* and *Programmers' Reference uide,* both published by Commodore. ere are several example programs cluded at the end of the book and these e well worth studying as they provide a eful example of how Basic is used in actice, albeit at a rather simple level. owever, at £5.95 the book is expensive for at is provided.

At half the price is Tim Hartnell and Mark Ramshaw's *Getting Started on your Commodore/Vic-20* which also starts right at the beginning and takes you right through the principles of Basic programming. There is nothing about using the cassette unit nor any mention of machine code — for which I suspect beginners will be grateful — but details of how to use the sound and graphics capabilities of the 64 are mentioned briefly. These include high-resolution user-defined graphics and sound, but no sprites.

While some of the example programs are rather complex and sometimes obscure the principles that they are illustrating are not, and many of them are useful illustrations given the adequate commentary provided. Unfortunately, the use of the book as a reference is severely limited by the lack of reference charts, appendices or an index.

For owners of the 64, the three beginners' books are *Teach Yourself Computer Programming with the Commodore 64,* by L R Carter and E Huzan; *Commodore 64 — Getting the most from it,* by Tim Onosko, and *Easy Programming for the Commodore 64,* by Ian Stewart and Robin Jones.

The *Teach Yourself* book is cheap, at only £2.75, and follows a more or less conventional approach although it tends to get mathematical at times. Certainly the book is crisp and text-book like with a useful selection of appendices and index.

Once Basic programming techniques have been covered, the book goes on to look at applications and how to use the printer and disc unit with special emphasis at the end on using data files. There are many example programs including some for using sprites, sound and high-resolution graphics.

Tim Onosko's book is also intended for the beginner but has a much broader approach to all aspects of Basic programming. The book is well presented and wide ranging: from how the 64 should be connected and set up, to programming with the disc drive; from the Basic command set, to using and selecting software packages including word processors. What the main text lacks in detail is made up for three appendices written by different authors covering the more intricate features of the 64. The book is expensive at £7.95 but worth considering.

Easy Programming for the Commodore 64 is only a little cheaper at £6.95, but it is undoubtedly one of the best and most thorough introductions to Basic programming that I have seen, with more than adequate coverage of all aspects of the 64, including sound, graphics, cassette and file programming. The book is full of examples — many of them short and to the point, and designed to be tried out as the text is read.

The techniques used in debugging programs are often forgotten in books for beginners, but not so in this case. All this, coupled with many exercises — complete with solutions — for the reader to carry out, many good example programs, an adequate set of appendices and two indexes make this book extremely good value.

For the more advanced programmer, Melbourne House has two books *Vic-20 Exposed* and *Commodore 64 Exposed.* Both books are similar in their coverage. They are really intended for use by more experienced programmers and are comprehensive in their coverage of the internal structures of both the Vic and the 64, making them useful reference books.

The books cover aspects of disc and printer operations, with only the briefest

(continued on next page)

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mention of how to use the devices. Most of the coverage is of the very advanced disc-programming commands that only the most enthusiastic of programmers are likely to want to use.

For those who simply want a book of games programs, Robert Erskine and Humphrey Walwyn have produced *Sixty Programs for the Vic-20* and a similar collection for the 64. To provide 60 programs for only £5.95 is good value under any circumstances, and when the games are of reasonable quality and variety, then this becomes exceptional value.

All the games in the two books are written in Basic, and range from the Space-Invaders type of arcade game through to tests of mental agility and quizzes to a couple of utility and educational programs. They are not all rehashes of all the old favourites, although these are not forgotten entirely, among a number of new and innovative games.

Both books use the graphics capabilities of the machines, including sprites on the 64, and the Vic programs state clearly which memory configuration is required for each game. If you yearn for serious games, Mr Walwyn has also written *Micro Wars on the Commodore 64*. This is a collection of six programs which range from a simulation of the Battle of Waterloo to a real-time Torpedo Bomber game.

There is more than adequate commentary on each game listing, including the historical background. There are also several printouts taken from the screen displays, all of which makes for a well put together collection. But don't be fooled into thinking that these games are easy to play — all of them are designed to tax the wits of the players and are as different to the normal arcade-style games as could be imagined.

If your tastes go as far as writing your own games. Mike Grace's book *Commodore 64 Adventures* describes the process of writing an adventure game from scratch. The first section of the book explains the principles behind writing an adventure game and develops a framework into which any simple adventure scenario could be slotted. This includes the more complicated problems of setting up the necessary maps and plans, and how they can be represented in the computer.

The second section takes these techniques and develops them into a complete adventure game called Nightmare Planet. This is written in modular form with an excellent commentary full of notes and anecdotes about the problems likely to be encountered and their solution. The techniques, which include programming graphics, sprites and sound, can be utilised to produce your own adventure games and the book is a superb introduction to this type of game.

If gaming is not your scene, there are four books intended for those taking their computers that bit more seriously. Boris Allan's *Graphic Art on the Commodore 64* develops a high-resolution turtle-graphics system for the 64 and then shows how such a system can generate graphics effects.

The actual turtle-graphics program is made up from Basic subroutines which are developed during the course of the text, but at no time is the complete package presented in a form ready to be typed into the computer. Instead, it is necessary to pick out the relevant subroutines from all over the book and piece them together — fortunately, the line numbering has been chosen to make this relatively easy.

Mathematics on the Commodore 64 by Czes Kosniowski contains a variety of mathematical routines for use in your own programs. Although they are designed for the 64, the Vic and other Commodore machines use the same Basic so most of the material can be used on these machines with little difficulty.

The range is wide, from codes and cryptography to random numbers, from trigonometry to manipulating dates. The commentary is clear and concise but does need some understanding of mathematics to be able to understand it fully.

Along similar lines is *Basic Subroutines for Commodore Computers* by Eddie Adamis. The big difference with *Basic Subroutines* is the triviality of many of the routines it provides and I have serious doubts as to how many people will need to buy such a book in order to have a program to convert, for example, kilograms to pounds, or degrees Fahrenheit to degress Centigrade. To be fair, there are sc useful programs included, such as ma operations and some financial progra but the overall level is more suited beginners.

The final applications book to examined is James W Coffron's *The Vic Connection,* which is devoted to interfac the Vic to the outside world. Its 260 pa are packed with software and hardw descriptions for very simple interfac tasks, from driving light-emitting dio right through to designing a spee synthesis unit for the Vic. The bo concentrates on both hardware a software aspects of interfacing, a assumes knowledge of Basic and elementary electronics, although some the concepts required are explained as book progresses.

Many circuit diagrams are includ mostly using readily available componer but there may be problems obtaining Votrax speech synthesis chip SC-01 or Creative Microprocessor Systems I board which provides a visual indicatior the output port of the Vic. Fortunately, principles involved are explained v enough to allow the techniques used to adapted for use with other components

The book has copies of the ma facturer's data sheets on some of devices used and a section on how to re circuit diagrams but it does not provide a construction details for the many projec Despite all this it does provide a valua resource for the Vic enthusiast.

Basic Subroutines for Commodore Computers by Eddie Adamis. Published by Joh Wiley, £12.95. ISBN 0 471 86541 9

Commodore 64 Adventures by Mike Grace. Published by Sunshine Books, £5.95. ISBN 0 946408 11 4

Commodore 64 Exposed by Bruce Bailey. Published by Melbourne House, £6.95. ISBN 0 86161 133 0

Easy Programming for the Commodore 64 by Ian Stewart and Robin Jones. Published by Shiva Publishing Ltd, £6.95. ISBN 0 906812 64 X.

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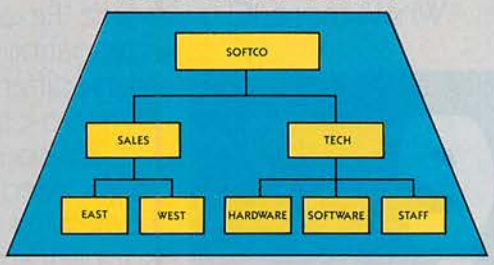

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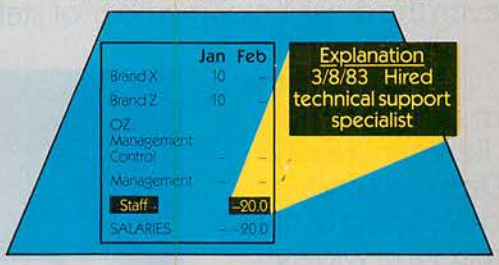

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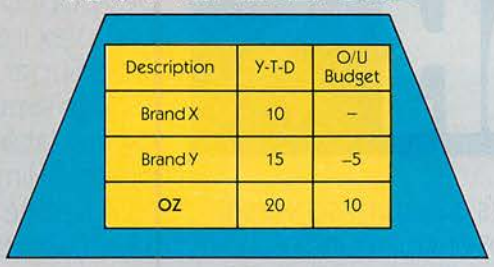

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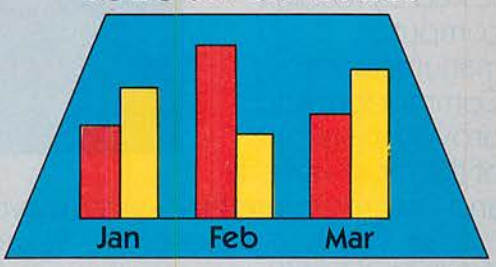

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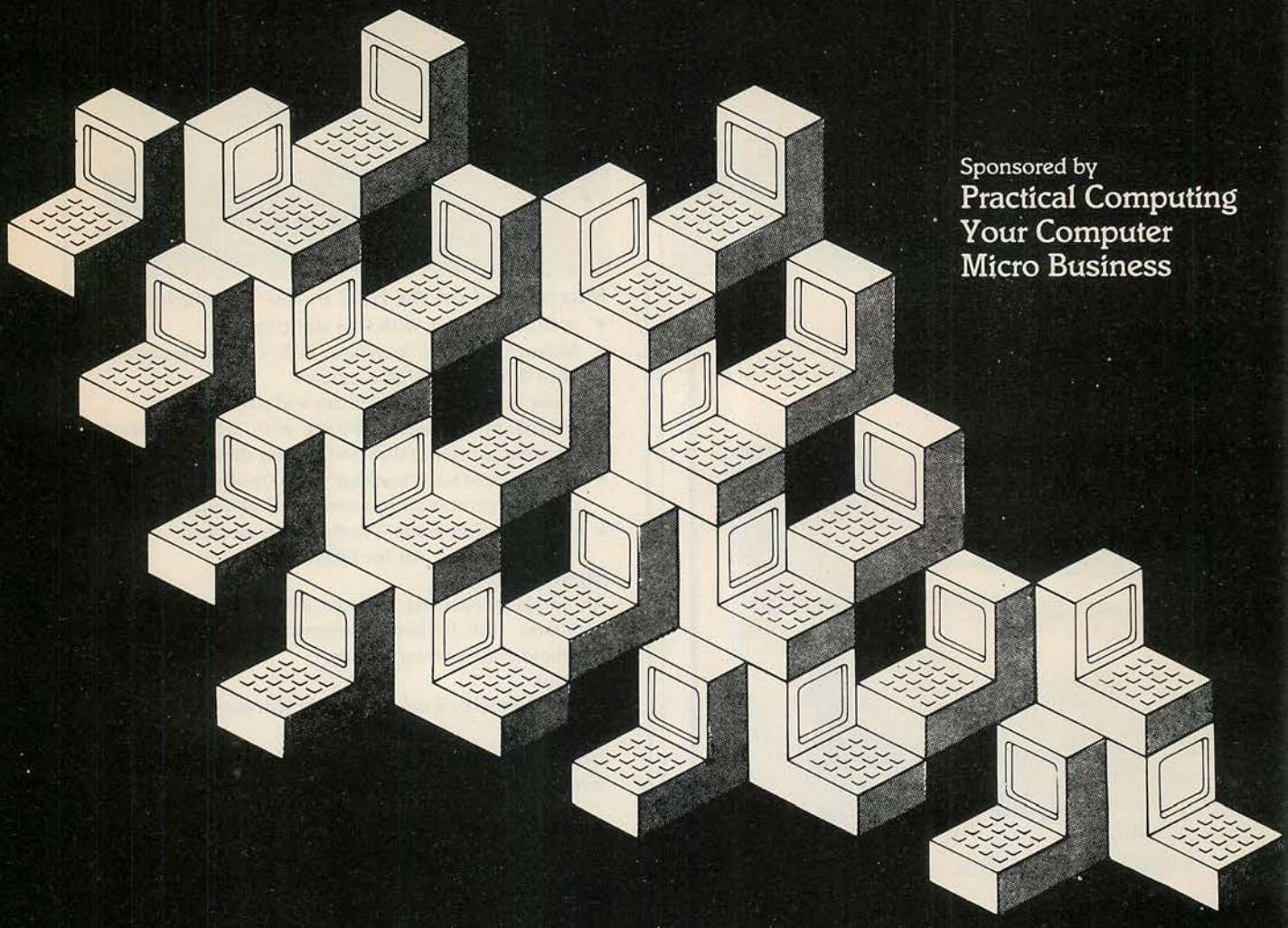

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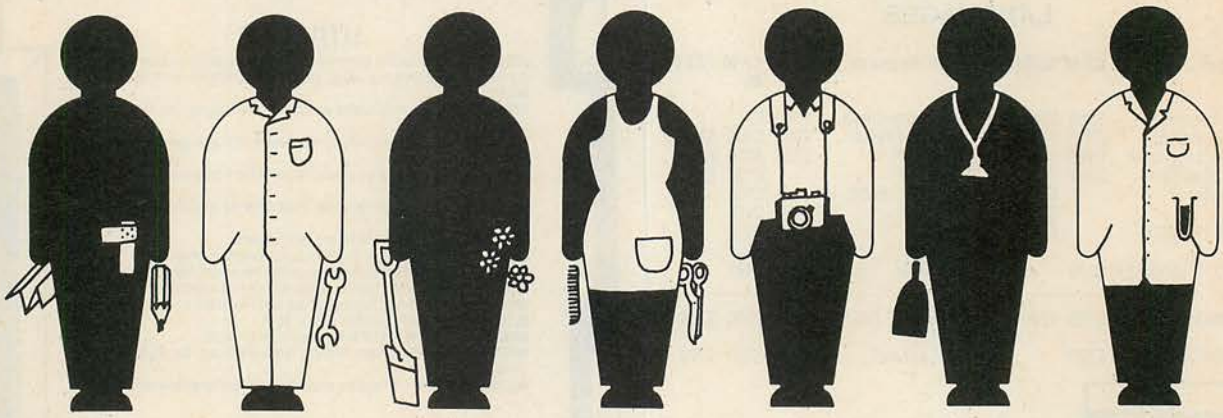

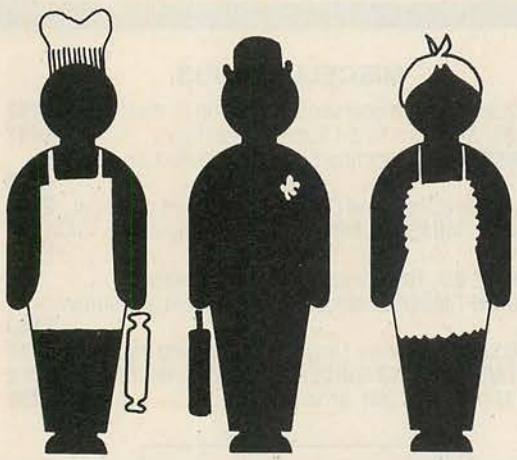

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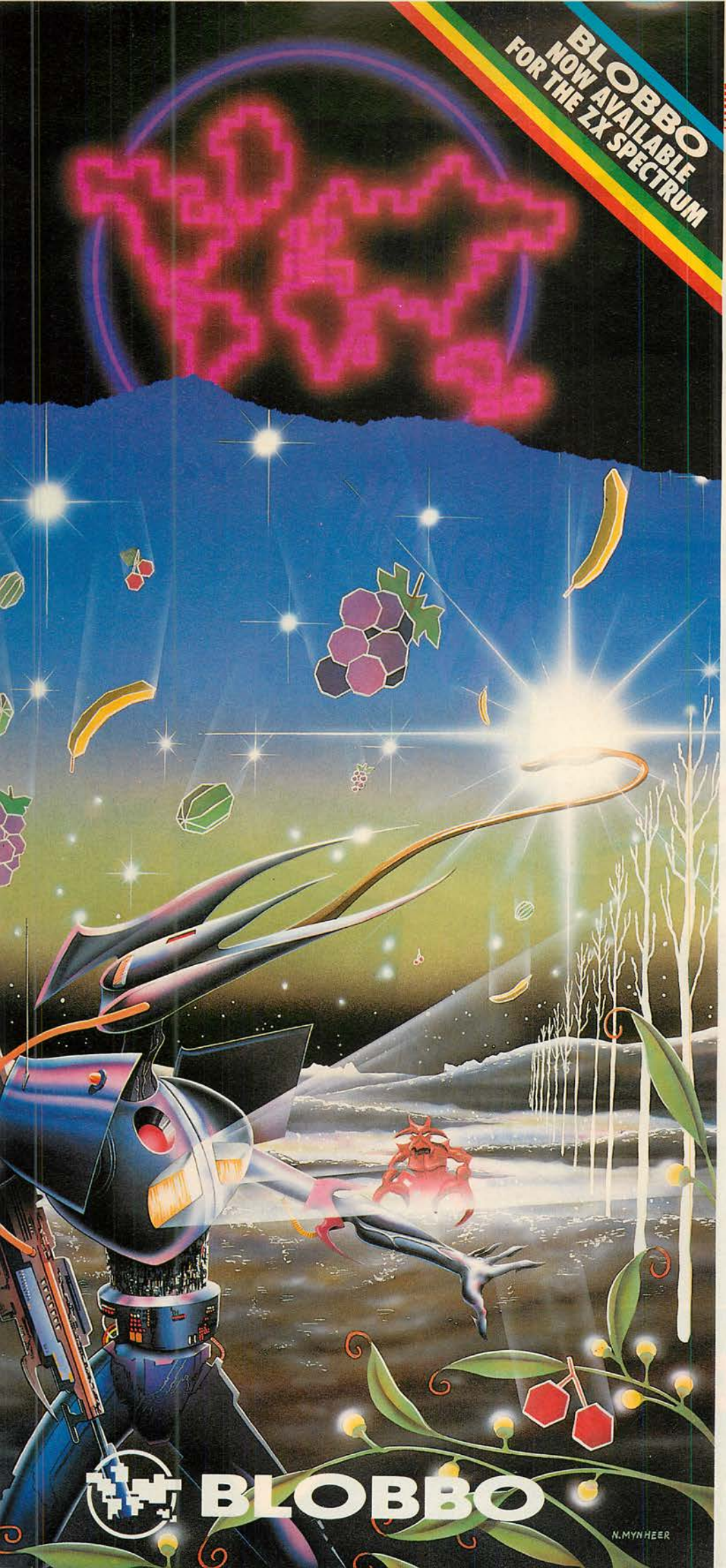

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>NEXT MONTH

>FREE! 16-BIT SUPPLEMENT

Following the enormous success of last year's special 16-bit supplement we've decided to do it again — only better — with a practical guide to most of the dozens of machines available.

>OPERATING SYSTEMS

The special section inside the April issue will be devoted to operating systems, including CP/M, MS-DOS, Unix, Pick and other important examples of the software writer's art. You may not like them, but you can't run software without them.

>REVIEWS

The Kaypro, voted Transportable Computer of the Year, gets the full treatment next month. Among the pieces of software piling up in the office are three of the heftiest packages of all time — Tomorrow's Office, Delta and Rescue. By next month lucky Paul Myerscough might have finished reviewing them on the IBM PC. We will also be comparing two Commodore 64 spreadsheets: Practicalc and Multiplan. We will be surveying the transportables available, and for light relief there is a round-up of games on the BBC Micro.

>YOUR GOOD HEALTH

Among the features next month you will find Chris Naylor stripping off to try some of the many programs which help you to stay young, live longer and diagnose your own diseases. The Bensons return with part 2 of their series on Apple interfacing — if you missed part 1 it was last month. And of course there will be the usual round-up of news, views, programming tips and book reviews, not to mention the pages and pages of free software in Open File.

Make sure you don't miss the April issue of

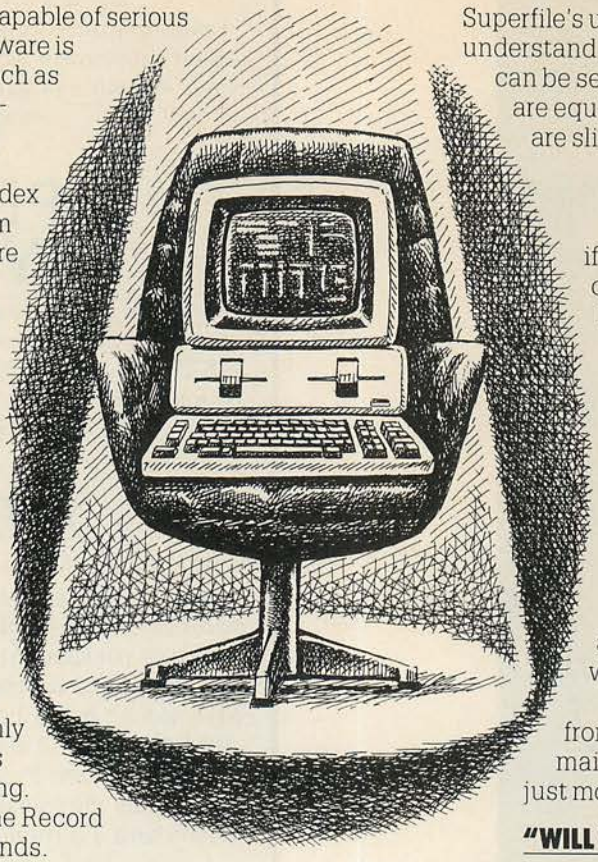
Practical Computing

On sale at W H Smith and all good newsagents after March 14.

SOME SEARCHING QUESTIONS TO ASK A DATABASE MANAGER

Now that microcomputers are capable of serious data storage, the hot phrase in software is 'database manager.' A good one, such as Superfile, turns a micro into a hyper-intelligent filing cabinet, combined with an amazingly deft assistant.

Any business that uses a card index or a filing cabinet would benefit from a database manager. It could do more for an enterprise than hiring a new executive – but it is necessary to be just as careful when interviewing candidates for the job. Vast sums of money are lost by companies investing in software that doesn't work hard enough. So it's vital to ask the right questions – and get the right answers.



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"You may do well with a small database, but how much can you store? How fast are you when full?"

Superfile's capacity is limited only by the hardware. The 8 bit version is fast, but the 16 bit version is lightning. On a suitable machine it can find one Record out of a hundred thousand in 3 seconds. A lot of main-frame computers would like to do as well.

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"ARE YOU MULTI-USER?"

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● **Circle No. 171**

Fifth generation panic

Christopher Roper speculates on the significance of developments in AI research.

THE CURRENT panic in the U.S. about the Japanese fifth-generation computer project is reminiscent of an earlier scare over the Sputnik. Politicians and newspaper editors are wringing their hands over the U.S. educational system, and asking where it all went wrong.

Now, as then, a good deal of the hue and cry is directed towards extracting more money from public funds for expensive research projects. This time it is the turn of the artificial intelligence research community, and one public manifesto of this group is a best-selling book called *Fifth Generation* by Professor Edward Feigenbaum of Stanford University and Pamela McCorduck, an AI journalist.

Neglect

The book's message can be summarised as follows: AI research has been neglected in the U.S., despite clear demonstrations of its feasibility and utility. Now the Japanese are building intelligent machines which will dominate the world market in the 1990s, and America should wake up to the situation.

Although damned by the *New York Review of Books,* the book is important at a time when Clive Sinclair and Acorn Computers are claiming to be about to fill their next generation of micros with AI goodies.

There are people who object on moral grounds to the idea of attempting to simulate human intelligence. Others do not believe it can be done, either purely because it has not yet been done, or because they do not believe there is any correspondence between the way a human thinks and the way a computer works.

McCorduck mentions these objections, but omits the most telling objections of all. These have to do with the very nature of knowledge and information, and the limitations of human language as a map of reality. AI workers are no closer than they were 25 years ago to providing a program which may be said to understand natural language, or generate its own language to explain concepts which it has discovered.

The Japanese are pinning their hopes on highly parallel architecture, and on Prolog, which is a programming language built up from declarative sentences such as "John is the father of Mary" and rules of inference. McCorduck and Feigenbaum speak as if it were an established fact that this combination will usher in a new age of intelligent machines. There is no good reason to suppose that it will, though almost certainly the Japanese will make some exciting discoveries along the road, build some fancy computers, and generally advance our understanding of programming languages.

Readers of *The Fifth Generation* should be warned of the authors' sleight of hand. A great deal of the book is about the construction of expert systems. The building of these systems, designed to permit the detailed analysis of a large body of specialised data, represents a triumph of the programmer's art, but has nothing to do with the goals of the AI as they were originally laid out in the 1950s.

The authors describe the process by which a "knowledge engineer", to use their misleading label, works with an expert to translate his or her analytic skills into a computer program, operating on a complex but limited domain such as the diagnosis of blood and meningitis infections. However, such programs have a limited utility since their reliability drops when used by non-experts.

Perhaps the best measure of the continuing failure of AI in achieving its primary goals is the lack of progress in producing a program which will satisfactorily translate one natural language into another. Moreover, having had the experience of struggling with the Epson printer manuals for some days, I have little hope that a Japanese logic machine, even if it did operate at a speed of 100 million logical inferences per second, would use English in the way I use it. And I am convinced that it would not process knowledge in the same way that I process it.

The problem is that everything which goes into a computer is language, and everything which comes out is language. We can agree on the meaning of mathematical and other formal languages, but we are still miles away from any agreement on the multiple meanings of natural language.

Limits

Some computer scientists suggest that there may be theoretical limits to what computers can do, and that these limits are more likely to be discovered by philosophers and psychologists than by engineers. Exciting work is being done in this field, both at Stanford and at the University of California at Berkeley. A fundamental insight is that language does not simply represent knowledge, it is first of all a distinctively human action. When a computer outputs language, it is the projection of the human being who programmed it. Those interested in pursuing further the topic of AI should read Herbert Dreyfus' book *What Computers Can't Do.*

Reading McCorduck and Feigenbaum, it is easy to feel that the world has gone totally mad, that there are people at large who would really like to subordinate human beings to machines. The reality is probably even more depressing. Although they stoutly deny it, they seem quite willing to do without human beings. McCorduck has a chilling fantasy of being cared for in her old age by a robot which will read to her and listen to all her jokes without getting bored.

It is both interesting and odd that governments are willing to spend untold millions in the quest for artificial intelligence rather than spending the same money on making personal computers easier to program, and therefore more useful to human beings. Computers can be used creatively to enhance human intelligence, and it seems sad to waste so much energy on trying to replace it.

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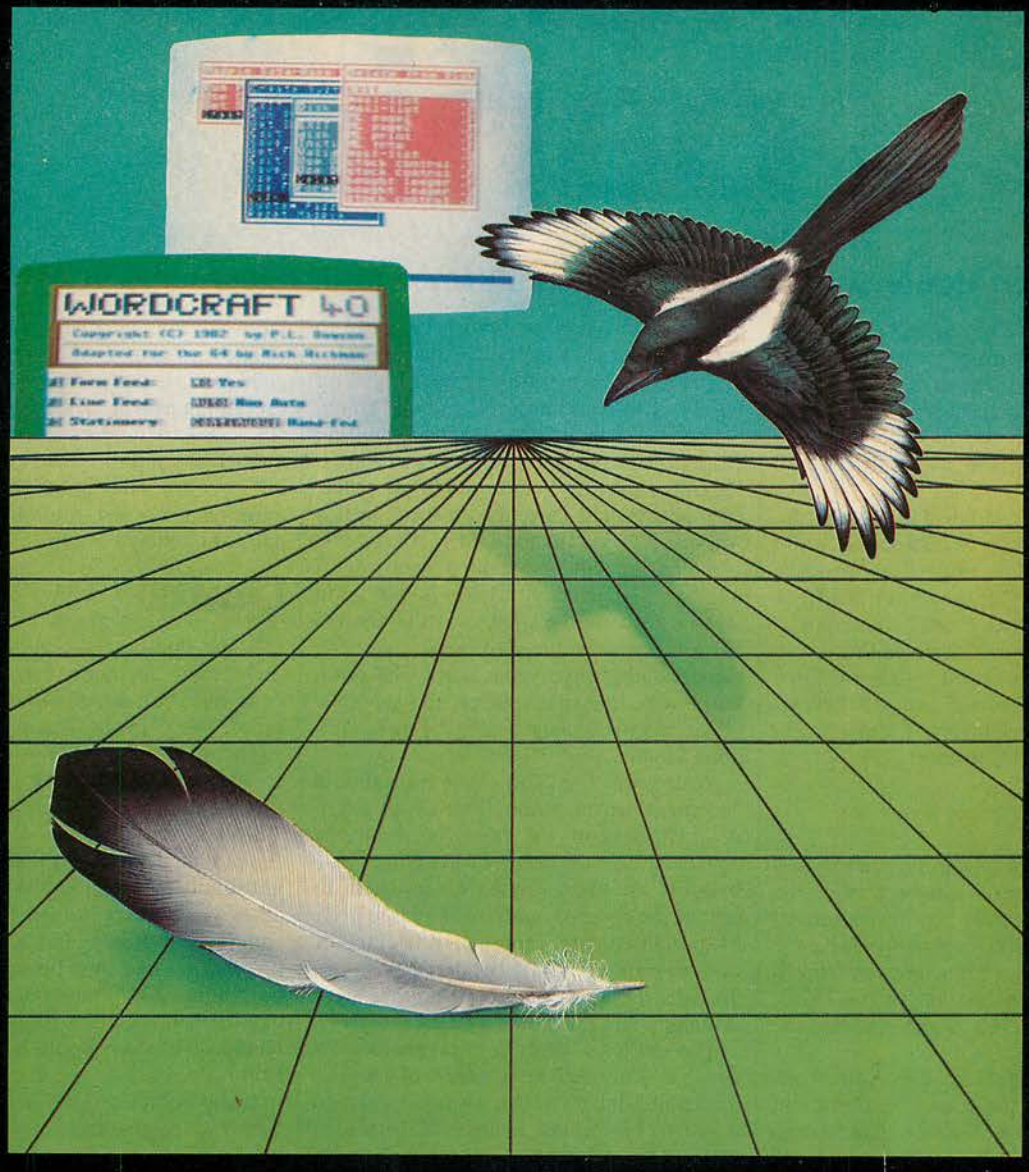

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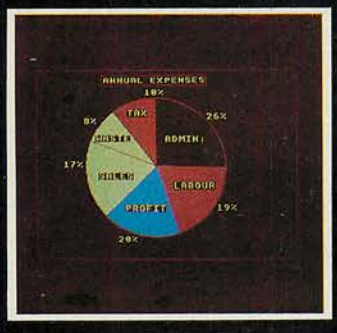

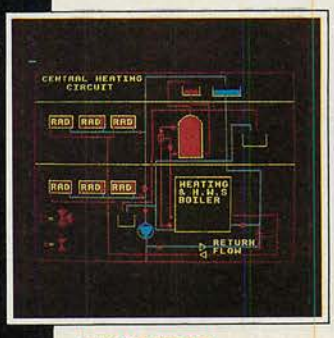

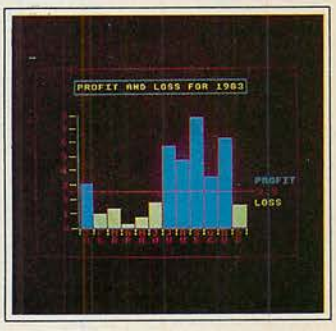

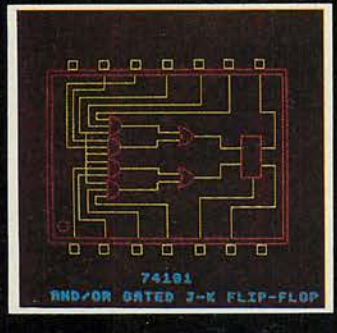

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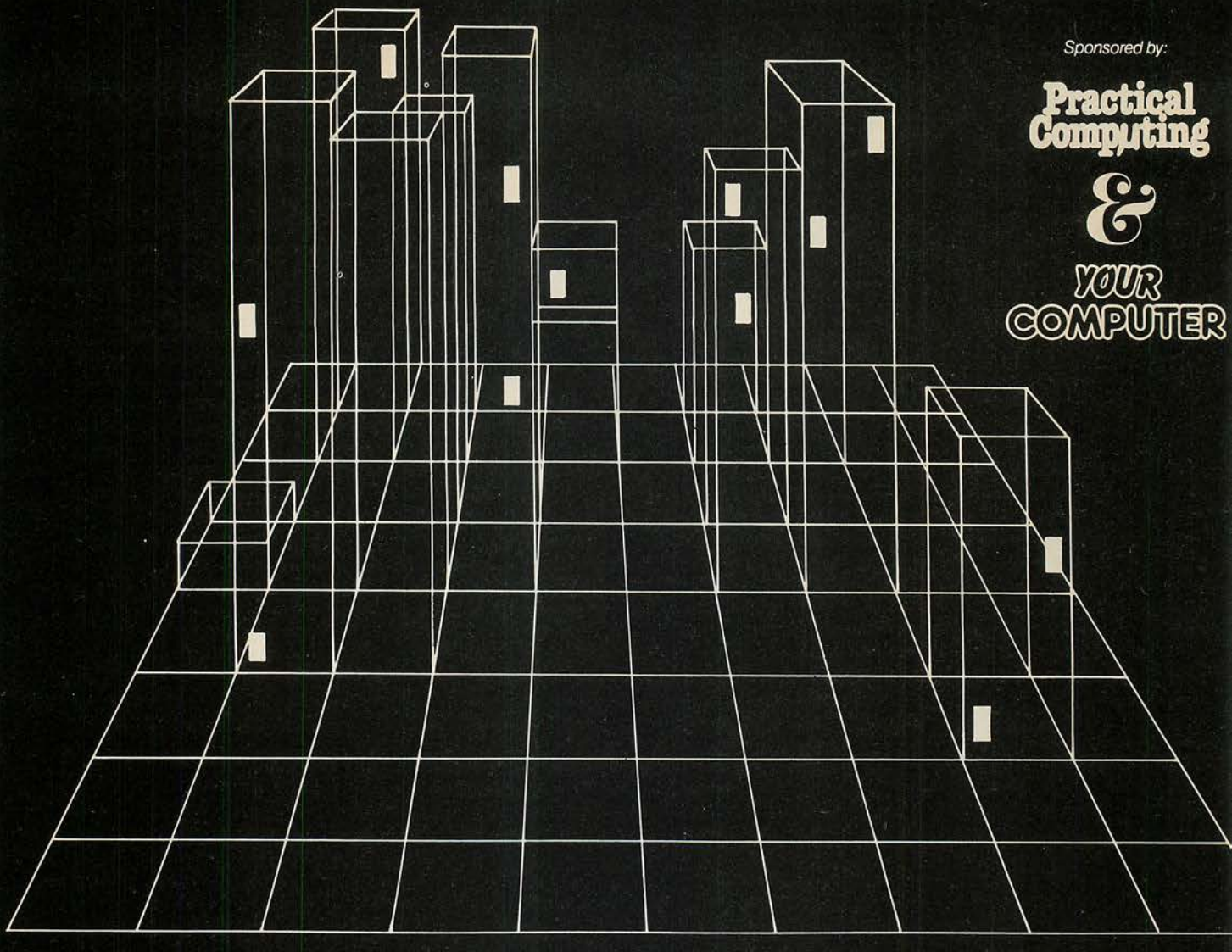

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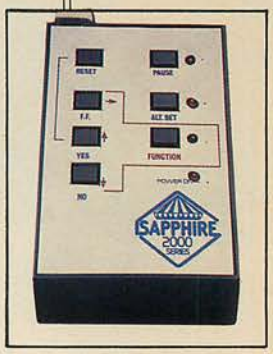

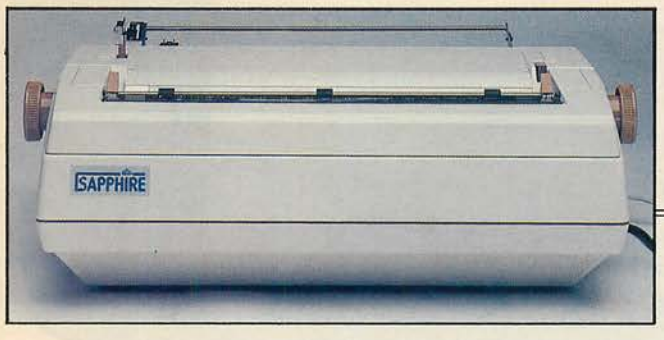

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The Computer Trade Conference '84

Wembley Conference Centre
March 13–14

TUESDAY, MARCH 13TH

RETAILING

8.30 COFFEE AND REGISTRATION

9.15 Mass Retailing of Business Micros — Michael Milman, managing director, Greens Business Systems (a subsidiary of Debenhams Ltd.)

9.55 How dealers should present themselves — Chuck Hansen, managing director, Computerland.

10.35 COFFEE

10.55 What Apple expects from their dealers; what Apple gives their dealers in return — Keith Hall, sales and marketing director, Apple Computers (UK).

11.55 Retailing through education and training — G. Summers, managing director, Planning Consultancy Ltd.

12.25 LUNCH

MARKETING TO THE PROFESSIONAL AND CORPORATE MARKET

2.00 Choosing Your Products — Jack Schofield, editor, Practical Computing.

2.40 Market products and sales channels — key considerations in the building of the dealer programme — John Crawford, vice president, world wide dealer programmes, Data General Corporation.

3.20 Personal computer dealer marketing in 1984 — Nigel Henzell-Thomas, personal computer dealer manager, IBM Ltd.

3.45 DEC's approach to the marketplace — Mike Harding, marketing specialist, Digital Equipment.

4.10 How to approach the corporate customer — Hal Hovland, joint managing director, Hovland Business Systems.

4.50 CLOSE.

WEDNESDAY, MARCH 14TH

SOFTWARE

8.30 COFFEE AND REGISTRATION

9.15 Vertical market software — coverage of vertical markets by specific packages varies greatly — some sectors are over-supplied and there are many open opportunities — Russ Nathan, managing director, Romtec.

9.55 Procurement — How you evaluate software from various sources — David Turley, director information systems division, Tamsys.

10.05 COFFEE

10.55 Marketing Software — The Business Market — Barry Neil, sales manager, Micro Computer Products International Ltd.

The Games Market — Nick Alexander, managing director, Virgin Games.

11.35 Systems and applications software developments — David Fraser, general manager, Microsoft Ltd.

12.15 LUNCH – Guest speaker – John McNulty, McNulty's Interchange.

SYSTEMS INTEGRATORS AND OEMs

2.00 Communication is the key to office automation — Malcolm Reip, OEM marketing manager, Computer and Systems Engineering PLC.

2.40 Discs and Peripherals — Bob Britten, sales and operations manager, Kennedy International Inc.

3.20 Printer products and the markets — Alan Clemmetsen, consultant, Mannesmann Tally.

4.00 Market trends in VDUs and VDU terminals — Harvey Ulijohn, managing director, Lear Siegler Data Products Ltd.

4.40 CLOSE.

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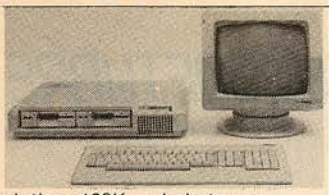

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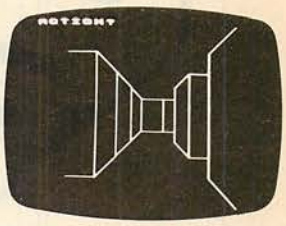

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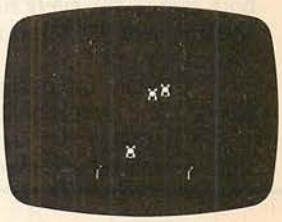

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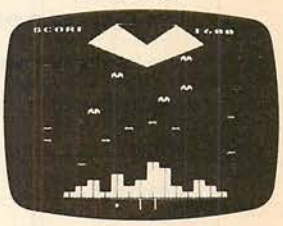

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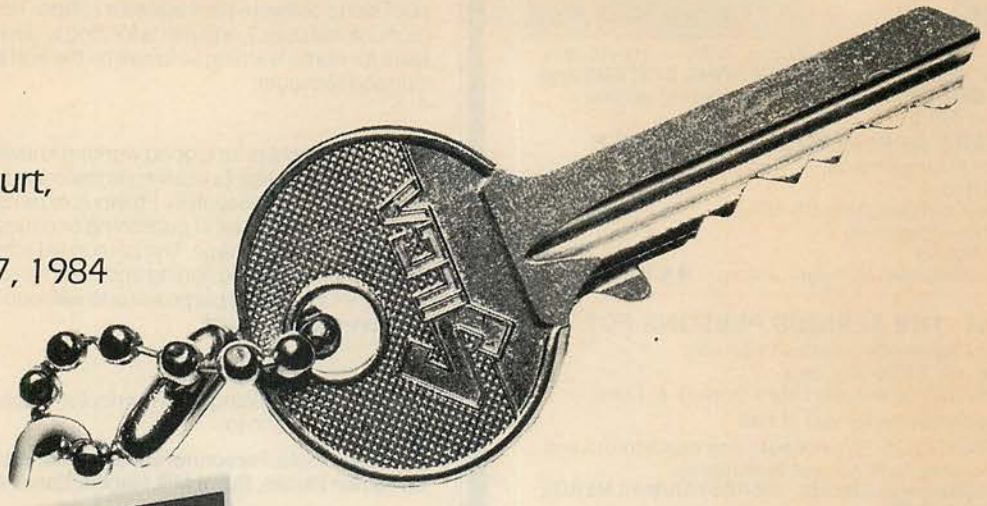

software '84
EXHIBITION AND CONFERENCE

Certainly the major software event of 1984 will be **Software '84,** to be held for the first time in Central London. **Software '84** will be totally dedicated to professional software sales and will be held from June 5-7, 1984 at Earls Court in the centre of London, the Nation's biggest commercial market place.

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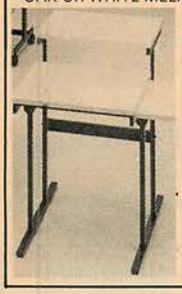

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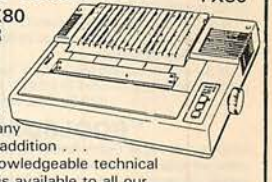

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